FM 8–36

FIELD MANUAL

THE AIDMAN'S MEDICAL GUIDE

HEADQUARTERS, DEPARTMENT OF THE ARMY

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CHAPTER 1
INTRODUCTION

1–1. Purpose and Scope

This manual is intended primarily for you, the medical aidman in the field. It tells you what to do with the supplies and equipment that you can carry and can use without hot or running water or electrical power. It also tells you how to protect yourself and your patients. The first eight chapters of this manual deal primarily with trauma: injuries and wounds. The last nine chapters of the manual deal essentially with medical diseases. Your comments to improve this manual will be welcomed. Send them direct to Commandant, ATTN: MEDEW-ZNT, US Army Medical Field Service School, Brooke Army Medical Center, Fort Sam Houston, Texas 78234.

1–2. Definitions

Self aid, first aid, and *buddy aid* are emergency medical procedures carried out by anyone, whether trained or untrained in medicine. *Emergency medical care* is early care given by trained medical personnel. *Definitive medical treatment* is that specialized care of the sick and wounded given by highly trained medical personnel, ordinarily the doctor. The steps taken by individuals in these different treatments may be the same, with only the equipment and application differing.

1–3. Your Resources

In the field, you can give emergency medical treatment but you do so with limited resources. Your physical resources are limited by two things: the tactical situation and how much you can carry. You are trained to improvise in some situations, and to request assistance in others.

1–4. Your Main Job

In addition to lifesaving and first aid measures, disposition of patients is your job. When a soldier is wounded, or when you are faced with a medical problem, ask yourself, "Should I evacuate this man or treat him here?" Often, the tactical situation and

the nature of the man's illness or injuries require *you* to treat him. This manual tells you *how* to treat him.

1–5. Dealing With Your Fellow Troopers

The personal relationship between you and the troops you support is very important. If you command the confidence and respect of the troops, you can do a far better job of treating them. At first, you earn their confidence and respect by how well you conduct yourself in everyday dealings with them, not by treating patients in combat. The aidman who is accepted by his troops is known to them as "Doc." Such a nickname implies you have the respect and trust of the men you serve. To get this you have to be more than a skilled medic. You have to be always willing to help a trooper any way you can.

1–6. What a Good Aidman Does

a. Most of your time is spent, not in combat and treating patients, but in waiting. While waiting, you care for your equipment and replenish your supplies, but equally important you talk with the troops. You are the ever-present advisor on their *minor medical problems* and the *minor medical problems* of their families at home. Often a soldier concerned about the medical problem of someone in his family comes to you for information. You are not expected to have the answer to every question. Yet if you are attentive, sympathetic, and honest with the soldier, you will be remembered kindly.

b. You must do your share of the hard work. You cannot afford to be known as a "goof-off." You are expected to defend yourself and your patients when necessary. You are not supposed to carry a radio or parts of crew-served weapons, but do not hesitate to help a fellow soldier carry a heavy load when you are not in contact with the enemy.

c. Besides doing your share of the work, you will always look out for the welfare of your troops. Before the unit goes on a mission, check out each man. If you find a soldier with a medical problem, go to the platoon sergeant and tell him the man's condition, capabilities, and limitations. During the mission, observe each man. If you get to know the men well, you can tell quicker when one is getting sick. You can anticipate many medical problems. For example, if you know the troops are on short water rations in hot weather, you might anticipate a case of heat exhaustion. Some water from your canteen may prevent it. (You may carry an extra canteen of water to help eliminate this situation.)

d. At the end of the mission, check each soldier again to see if any are sick or hurt. Some will get minor wounds but not complain about them. In checking out the men, explain the [illegible] infection to them. Take every opportunity to encourage preventive measures, such as foot inspections, especially after a long, hot march.

e. During rest periods and between missions, you should make sure all minor medical problems are settled. You may want to go with a trooper on sick call and learn from the medical officer the best way to continue treating him. If medication is prescribed, you should be certain it is taken correctly. All the time, you should support your troops when medical problems are involved. If you do, they will respect and support you.

1–7. Preoperational Briefings

Commanders usually include medical personnel in briefings before a mission. If you are not included, find out all you can after briefings. The more you know about the mission and its likely medical hazards, the better you can do your work. When altered for a mission, go to the platoon sergeant or the platoon leader and ask about it. Find out how far the men are going, how many are going, how long they will be away, and how much enemy action is expected. Then you can decide what supplies to take.

1–8. Tools and Equipment

On a combat mission you carry only the supplies you *need* and know how to use, not what is *nice* to have. You are responsible for your aid bag, water, weapon, and ammunition. The weapon may be one of a type that is organic to the unit you support or it may be the one the tactical commander thinks best for you.

1–9. Your Aid Bag

The surgical instrument and supply set, individual, is a general use aid bag issued by the medical depot with a standard packing list of supplies. This standard aid bag is a starting point for you. It is intended for use as a general-mission bag, not a special-mission or all-mission bag. You are responsible for packing and maintaining your aid bag. The aid bag and some items carried by an average aidman appear in figure 1–1. (See also chap. 18.)

a. What you will need to carry in the aid bag depends upon the nature of the mission. For example, if the mission is to be a walk to and a look around a village, lasting about 2 hours and taking 15 men, with no enemy action expected, you would take a light bag of supplies. If the mission is to go several miles away, taking 40 men and setting up a night ambush, with enemy action expected, you would take a different bag of supplies. If the company is going on an extended mission, you would take still another aid bag.

b. As your knowledge and experience increase, you will change items in your aid bag. Some items, like field dressings, bandages, and aspirins, should always be included while others, like antibiotics, should not be taken to the field without permission of the medical commander. Contents of aid bags also vary with the area of operations, local policy, and supplies available.

1–10. Steps in Solving Medical Problems

a. Get a history and do a rapid physical examination of a patient. For example, without asking needless questions, find out whether the wound was caused by a bullet, a mortar round, a booby trap, or a fall from a vehicle. If it is a perforating wound, see if it has caused more than two holes. Determine the number of wounds. Find out if there is severe hemorrhage, internal bleeding, or a broken bone(s). Quickly assess the vital signs (pulse, blood pressure, respiration) to determine whether the patient's life is in danger.

DRESSINGS, BANDAGES, VASELINE GAUZE, INSTRUMENT SET, FIELD MEDICAL CARDS, SALT TABLETS, ASPIRIN, ANTI-MALARIAL TABLETS, ANTIHISTAMINE, WATER PURIFICATION TABLETS, BACITRACIN OINTMENT, TETRACAINE OINTMENT, GELUSIL, COUGH LOZENGES.

Figure 1–1. Surgical instrument and supply set, individual (aid bag), with typical contents.

b. Make a judgment or a tentative diagnosis. For example, if the wound is serious, will the patient die soon without definitive medical treatment? If the wound is not serious, can he continue his mission with some treatment? What is the tactical situation? How much time do you have? How much help can you get?

c. Take some positive action.

(1) Get yourself and the patient in the safest position consistent with his injuries and the tactical situstion.

(2) Clear the airway and give artificial respiration if necessary. Control hemorrhage as quickly as possible. Treat for shock if necessary.

(3) Ask for assistance. Move the patient to a safer place and request evacuation if indicated.

(4) Reassure the patient. Positive action will reassure him more than anything you can say to him.

d. For guidance in handling a medical problem beyond your capability, you may be able to go through communications. Most of the time the operator can connect you with a medical officer or other medical personnel who can tell you how to handle the problem. They can also dispatch personnel and equipment to help you.

CHAPTER 2
TACTICS FOR THE AIDMAN

2–1. Staying Alive and Well

When you go into combat, staying alive and well is mostly a matter of training, not luck. If you become so engrossed in any activity that you forget the lessons of basic combat training, it could be fatal. Other valuable points on tactics are found in FM 8–22, The Combat Medic.

2–2. Who is Your Boss?

You may wonder who your boss is, or whose orders you follow. The commander of the element you are supporting has operational control over you. He will tell you what you are to do to medically support his element and when and how he wants it done. The medical platoon/section/leader handles your administrative matters as well as technical supervision of your work. If you are concerned about your pay, leave, promotion orders or assignment orders, you should go through your command channels for assistance or information.

2–3. Where You Work

Where you are located in the platoon will depend upon the desires of the element commander. He must know where you are at all times. The most likely location for you is at or near the command post. That is normally where the communications are placed. You should be close to the communications but not so close that you become a target for snipers. If you have to leave this position, you must inform the commander. You should be where you are readily accessible to expected patients and where your men know they can find you. The commander may direct you to other positions depending on the situation. During night operations, especially during total darkness or stake outs, remain at a fixed location and move only on orders. You can easily be mistaken for infiltrating enemy if you wander around during darkness.

2–4. Working Under Fire

There are several things you should do if your element comes under attack. Hit the ground quickly. Look for a signal from the

tactical commander. Move to a safer position as soon as there is a break in the firing from the enemy. Look again for a signal from the tactical commander. If there is no signal from the commander, remain low and in as safe a position as possible. Get your aid bag in position. If someone is hit and calls for a medic, do not run out to him immediately. Ask the commander for a signal to move. If you cannot see the commander, be sure to tell someone to cover you while you move out. The "stay alive" rule is: be sure you are covered before you move out to render aid to a patient. Also remember that a single round going off usually indicates a sniper is doing the shooting. Do not run to the assistance of a man hit by sniper fire. You cannot always see the sniper. Usually he can see you and will shoot you as soon as you move into his line of sight. So, wait until the sniper is located and disposed of, or wait for a signal from the commander before moving out. Do not run immediately to assist a booby trap casualty. Allow the booby trap experts to escort you to him. Booby traps are often placed in clusters. Without expert help you too can get hurt by one. There are many rules of combat. You should learn as much as you can from the experts. If not, you may learn these rules the hard way.

2–5. Resupply on Missions

While you are out on a mission you can get medical resupply through medical evacuation channels. If you need specific items of equipment, they can be delivered by any available means. As a rule, it is best to request medical resupply at the same time that you request medical evacuation. The medical evacuation vehicles are manned by medical personnel who are knowledgeable and have quicker access to medical supplies and equipment than other personnel.

2–6. Evacuation Plan

a. You should become familiar with the evacuation plan before starting on a mission. The evacuation plan is dictated by the tactical situation. Normally, a general evacuation plan is announced by the tactical command after consultation with the surgeon. In his planning and briefing for each mission, the tactical commander will describe the plan for the particular mission. Only the tactical commander or element commander is fully aware of the tactical situation. Therefore, only he can state what the evacuation plan is at any given time. If the element commander denies your request for evacuation, accept his decision. Besides knowing the tactical situation, he is responsible for everybody, not just the patients.

b. You never order an evacuation. Instead, you request it through the tactical commander. When you decide an evacuation is needed, contact the command post and describe the patient's condition. After discussion of the situation, the commander will usually make the final decision about evacuation. Safe arrival and departure of the evacuation vehicle is his responsibility. He decides if it would be tactically sound to allow a vehicle into his area of operations then. If he denies your request, you have to do the best you can for the patient commensurate with the tactical situation.

2–7. Requesting Evacuation

a. You must prepare for the disposition (evacuation) of the patient after you have initiated lifesaving emergency treatment. You should concentrate on stabilizing his condition, as time and the tactical situation allow, before the evacuation vehicle arrives.

b. Determine evacuation categories of precedence and make your request. Categories of precedence for evacuation may change with the tactical situation. They dictate who is treated, when he is treated and by whom, and how, when, and where he is to be evacuated. In addition to the tactical situation, you must consider (in requesting evacuation) the nature of the wound or illness, the type of transportation available, and the medical treatment facility available. A critically injured patient should be evacuated as rapidly as possible to a clearing station or hospital for example. On the other hand, a patient with a foreign object in his ear is not urgent and probably can be treated at an aid station.

2–8. Categories of Precedence for Evacuation

Although your primary concern is with the patient's welfare, you have a responsibility to other troopers in the company. You should not endanger them by requesting needless evacuation. Yet, you must not let the patient die because of your failure to request proper evacuation. You should be guided by the nature of the wound or illness in determining which category to assign in the request for evacuation. The established evacuation categories of precedence are urgent, priority, and routine.

a. The urgent category is reserved for those patients who must be evacuated within 2 hours to save life or limb. This means that patient will be evacuated immediately with a maximum time limitation of 2 hours.

b. Priority patients are those who must be evacuated within 4 hours. Priority also includes any patients whose condition is expected to deteriorate to urgent. This does not mean that it will be 4 hours before the patient is picked up. Rather, he will be evacuated as soon as possible within the limitation of available aircraft resources.

c. The routine category is reserved for patients whose con-

dition is not expected to deteriorate for several hours, normally more than 4 hours. Patients at field locations who require a medical consultation or have any minor injury or illness requiring treatment beyond the capability of the field medical personnel patients will be picked up as soon as all urgent and priority patients are safely evacuated.

d. It is sometimes necessary to clear patients from an area of operation because of the tactical situation. For example, a soldier on a small patrol sprains his ankle. Although the injury itself may not require evacuation, continuing presence of the injured individual may reduce the effectiveness of the patrol. In such a circumstance, evacuation may be requested using the categories above. This will be followed by a statement that the tactical situation dictates evacuation. This determination must be made by the tactical commander.

2–9. Evacuation Vehicles

a. Air ambulance or "medevac" helicopters are generally the most desirable type of evacuation, but they are not always available. Patients may outnumber the helicopters available. The enemy may have air superiority or enemy fire may prevent helicopters from landing or taking off. The weather may be too severe for helicopter operations. The flight may be too far, or incoming helicopters may reveal troop locations to the enemy.

b. When medevac helicopters are not immediately available, you may consider other types of evacuation. A helicopter gunship or troop carrier may be able to get in to the patient when other aircraft cannot. Troop carrier or gunship pilots often volunteer to carry out urgent patients. You should realize that a troop carrier is not equipped to carry patients and has no medically trained personnel aboard. In the gunship or troop carrier the patient must share floor space with ammunition boxes and weapons and the ride may be rough. You must decide whether it is wise to hold the patient until better transportation is available or to subject him to quick but rough evacuation by gunship or troop carrier.

c. Ground ambulances and other wheeled vehicles may be available. However, the patient's condition may be worsened by transporting him on such a vehicle. You must decide whether it is better to hold and treat the patient or evacuate him by the transportation available.

CHAPTER 3

LIFESAVING MEASURES

3–1. Danger of Acute Hemorrhage

Acute hemorrhage is a rapid loss of blood from the blood vessels. In the event of an acute severe hemorrhage (loss of at least two pints of blood), an emergency is present. If the bleeding is not stopped, the patient will die.

3–2. Blood

Blood is a mixture of water, salts, protein, red and white blood cells, platelets, food, waste, hormones, enzymes, antibodies, and other substances. The three most important elements of blood lost in acute hemorrhage are water, salt, and red blood cells. Water is the fluid that fills the blood vessels so the heart can function properly. Water also keeps other elements in suspension so they can be carried throughout the body. Salt maintains the proper chemical balance of body fluids; it must be contained in fluids used to replace lost blood. Red cells carry oxygen to the whole body including brain, heart, and other vital organs.

3–3. Vascular System

Blood is contained in a system of tubes or vessels called arteries, capillaries, and veins which together form the vascular system. The heart pumps the blood through the system. If a blood vessel is opened, bleeding results.

a. Arterial Bleeding. Blood leaves the heart through the arteries under pressure. If an artery is opened, blood will come out forcefully in spurts. With each beat of the heart there will be a corresponding spurt of blood. The larger the artery, the more rapid the blood loss.

b. Venous Bleeding. Blood flowing through veins is under less pressure than in arteries. However, a break in a vein will allow blood to flow out of it. The rate of blood loss depends upon the size of the opened vein.

3–4. Control of Hemorrhage

Control of hemorrhage is primarily mechanical. The mechanics of control consist mainly of closing off the open blood vessels. This

may be done in several ways. The method most feasible in one instance may not be best in another instance.

a. Direct Pressure. This is the best and usually the most practical, method for the company aidman to use. In this method, blood vessels are compressed against bone and flesh, usually by a pressure dressing applied directly over the wound. Almost any bleeding can be controlled this way. A special type of direct pressure is to apply a clamp directly to the bleeding vessel to close it off. Caution must be exercised that only the bleeding vessel is clamped.

b. Pressure Points. In this method, the artery is compressed at a point proximal to the wound, stopping the flow of blood. This method is not recommended if pressure must be maintained for a long period of time, but may be useful temporarily until a pressure dressing can be applied.

c. Tourniquet. A tourniquet will totally stop the flow of blood in the arm or leg beyond the tourniquet. Consequently, although it will stop the bleeding by compressing all the vessels, it is potentially dangerous because it deprives the uninjured tissues of blood. As a general rule, if a tourniquet is necessary, place it as close as possible to the wound between the heart and the wound to stop the bleeding. Some arteries, however, pass between two bones (as in the forearm) and cannot be compressed by a tourniquet. This would necessitate placing the tourniquet on the upper arm to stop the bleeding. Patients who have tourniquets applied should be clearly identified with a "T" on their forehead. Once applied, a tourniquet should never be loosened or removed, except under the supervision of a medical officer.

d. Elevation. If bleeding from a wound is only venous or capillary, elevation of the wound above the heart may slow the flow of blood. However, elevation is of no value in control of arterial bleeding, and may aggravate fractures.

e. Combination of Methods. A combination of measures is usually most effective. One combination is to use pressure points until a pressure dressing can be applied.

3–5. Clotting

Blood clots are formed by a chemical reaction that occurs when blood platelets escape from blood vessels. Slowing the flow of blood from a wound improves conditions for formation of a clot. A gauze dressing placed over a wound slows the escape of blood and gives it something on which to form a clot. This is another reason why a combination of gauze dressing and pressure is the best method of controlling external bleeding in combat wounds.

3–6. Internal Bleeding

Internal bleeding often results from penetrating or perforating wounds of the body, especially the abdomen and chest. Shock in patients with such wounds is good evidence of internal bleeding. In the field you can do little to control internal bleeding. The patient must be kept still to allow maximum blood flow to vital organs and prevent further internal damage. He should be evacuated as soon as possible. Do not give anything by mouth.

3–7. Anoxia

Anoxia, or lack of oxygen, is the most critical medical emergency. Vital organs, particularly the brain, cannot withstand anoxia—that is, cannot be deprived of oxygen—for more than 5 minutes without being damaged permanently. Oxygen deprivation can occur in one or more of the following conditions.

a. The atmosphere can be deficient in oxygen or contain poisons that prevent the body from using oxygen it takes in. Examples of these poisons are toxic chemical agents (toxic gases), carbon monoxide, smoke, and hot gases.

b. The respiratory system may fail or be prevented from taking in enough oxygen. Respiratory failure can be caused by—

(1) Blockage of the air passages by foreign matter such as water (drowning), mud, blood, vomitus, or wound tissue or by swelling caused by burns or other wounds.

(2) Injury to the part of the brain that controls respiration.

(3) Collapse of the lungs because of chest wounds or filling of the chest cavity with blood.

(4) Depression of the respiratory center of the brain by morphine or other drugs.

(5) Severe, extensive lung disease such as pneumonia.

c. The cardiovascular system may fail to circulate red blood cells. This can be caused by failure of the heart or large blood vessels due to trauma or disease and by insufficient volume in the vascular system due to loss of blood, water, or salt.

3–8. Artificial Respiration in the Acutely Injured Patient

If a patient stops breathing you must assist him immediately. The situation will dictate the method to be used. Regardless of the situation, however, immediate steps must be taken to clear the airway. If spontaneous breathing does not result, positive pressure artificial respiration must be begun (para 3–9). This is the only acceptable method of artificial respiration. It can be given mouth to mouth, mouth to nose, mouth to oral airway tubing, mouth to emergency surgical airway, or protective mask to protective mask by a connecting tube. Mechanical devices for supplying posi-

tive pressure are available at aid stations. Methods using negative pressure, such as the modified Sylvester method, are of no value.

a. Wound of the Face or Neck.

(1) Clear the airway of blood clots and wound tissue.

(2) Place the patient in the best position for drainage.

(3) If the patient is not breathing, and if mouth-to-mouth or mouth-to-nose respiration is not possible, perform an emergency surgical airway and begin positive pressure respiration through this airway.

(4) Get assistance in controlling hemorrhage. Such a casualty may have two life-threatening problems: bleeding and breathing. Alone, you may be unable to save his life.

b. Wounding With Drowning. A soldier wounded while crossing a stream, a swamp, or a paddy often will sink under the water or mud. If you do not have time to recover him and move him to dry ground, you should do the following things—

(1) Raise his head above the water.

(2) Clear the airway of mud or debris with your fingers.

(3) Using mouth-to-mouth respiration, give him one or two quick puffs of air.

(4) Quickly remove some of his gear if it is too heavy to support.

(5) Give him a few more quick puffs of air mouth-to-mouth.

(6) Call for assistance.

(7) Give him a few more puffs of air mouth-to-mouth while moving him from the line of fire and toward dry land.

(8) If he is bleeding, request assistance in controlling the bleeding while continuing mouth-to-mouth respiration until his breathing is restored.

c. Blockage of Air Passage by Vomitus. This is a frequent cause of death. Vomiting can be expected in a patient semiconscious from heat exhaustion, or in a painfully wounded patient who has been given morphine, or in a man who has received a blow on the head or abdomen. Vomiting is common in a man who is unconscious, semiconscious, or stuporous while under the influence of alcohol or drugs. Aspiration (breathing in) of vomitus will block the airway. A person's airway can be blocked when he chokes on large pieces of food. Blockage of the airway requires the following immediate actions.

(1) Clear the airway of the blocking material.

(2) Give the man a few quick puffs of air mouth-to-mouth. If the blocking material cannot be removed and continues to block the airway, an artificial opening must be made in the trachea (para 3–10).

(3) After the opening has been made, the patient should begin to breathe. If he does not breathe, you should perform mouth-to-artificial airway respiration. Continue artificial respiration until he is breathing. If there is no carotid pulse, external cardiac massage plus artificial respiration should be performed as described in paragraph 3–11.

d. Failure of Respiration Due to Injury to Nervous System or Overdose of Drugs. At once begin mouth-to-mouth artificial respiration and continue it until the patient can breathe or mechanical respiration is begun.

3–9. Mouth-to-Mouth and Mouth-to-Nose Artificial Respiration

The only acceptable methods of artificial respiration, short of mechanical devices or surgical airway, are mouth-to-mouth and mouth-to-nose. Both are methods of inflating the patient's lungs with the aidman's breath. The mouth-to-mouth method is preferred, but when the patient's jaw is tightly closed by spasm or when he has a mouth wound, the mouth-to-nose method may be used. Both methods are illustrated in figure 3–1. Steps in the expired air technique are as follows.

a. Position the patient on his back.

b. Clear the upper airway by running your fingers behind his lower teeth and over the back of his tongue. Remove any dentures or foreign material.

c. Turn his head face up. Tilt the head back so that the neck is stretched and the chin is up (fig 3–1①).

d. Adjust the lower jaw so that it juts out (fig 3–1② and ③). This positioning moves the base of the tongue away from the back of the throat, thus clearing or enlarging the air passage to the lungs.

e. Seal the airway opening (either the nose or the mouth) which is not being used. The seal must be secure to keep air from leaking during inflation. Pinch the nostril shut with your free fingers or seal the mouth by placing two fingers lengthwise over the patient's lips (fig 3–1④ and ⑤).

f. Take a deep breath. Open your mouth wide and make an airtight seal around the patient's mouth or nose.

g. With your eyes focused on the patient's chest, blow forcefully into his airway. Rising of the patient's chest indicates air is reaching his lungs. If the chest does not rise, you must take these corrective actions.

(1) Hold up his jaw more forcefully and hyperextend his neck.

(2) Blow harder into his mouth or nose, making sure air is not leaking from the other airway opening.

(3) Recheck his mouth for foreign matter. If there is a defi-

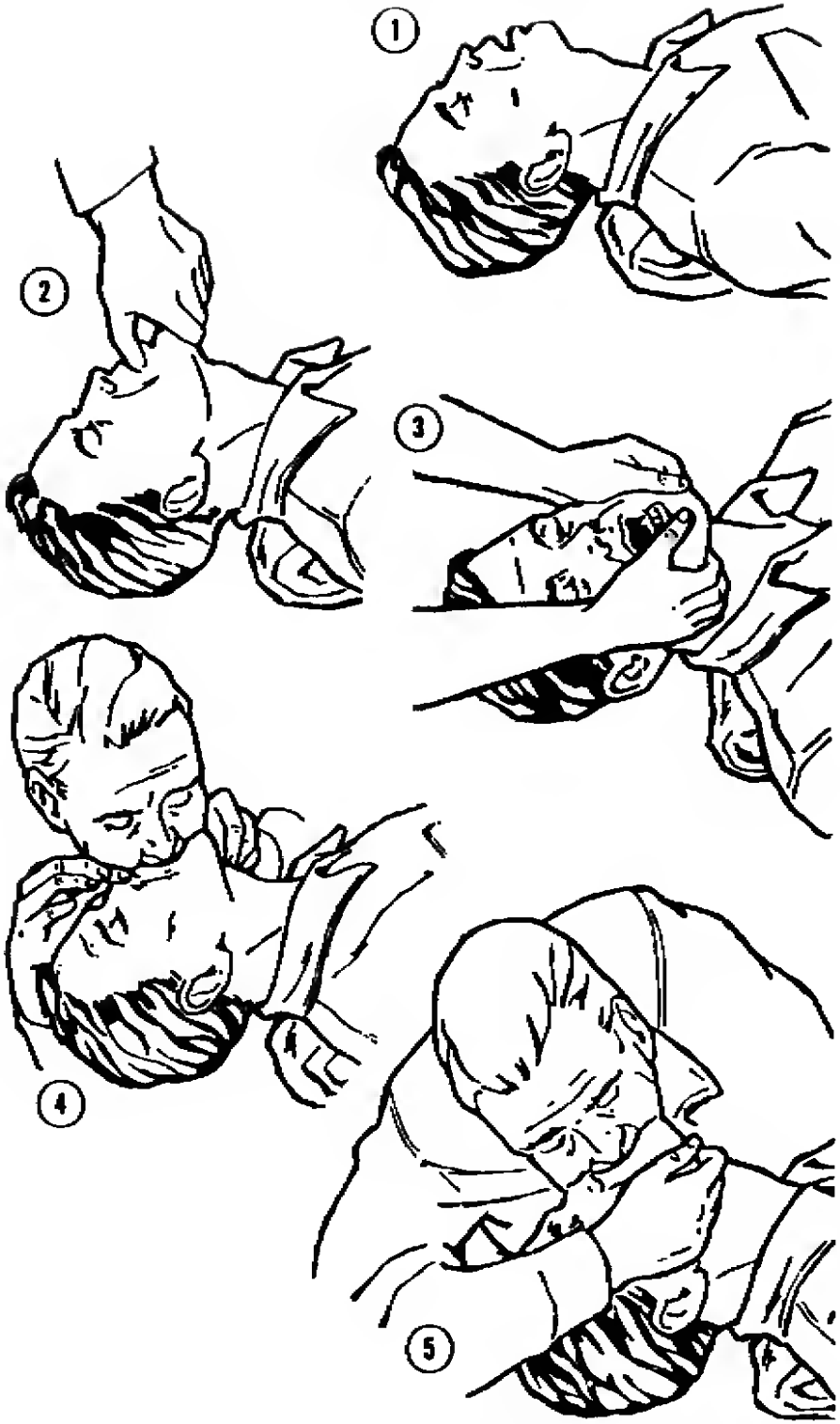


Figure 3-1. Steps in mouth-to-mouth and mouth-to-nose artificial respiration.

nite obstruction of the airway, an emergency surgical opening must be made.

(4) Remove your mouth, listen for the return of air from the patient's lungs. If the exhalation is noisy, elevate his jaw further.

(5) This procedure should be repeated 12 times a minute.

h. If these steps fail to permit inflation of the lungs, an emergency surgical airway must be made.

3–10. Emergency Surgical Airway

Again, most airway obstructions are relieved by nonsurgical measures. Clearing the upper air passages with the fingers, positioning the head, neck, and body, adjusting the lower jaw, or a sharp blow on the patient's back may be all that is needed to dislodge an obstruction. Persistent obstruction of the airway, however, requires an immediate surgical airway for relief. Diagnosis is established when the patient's lungs cannot be inflated by mouth-to-mouth (or mouth-to-nose) respiration.

a. A patient with persistent airway obstruction will be hard to restrain, if conscious, so you will need someone to help you hold him.

b. Quickly get the sharpest cutting instrument you can find.

c. Have your assistant immobilize the patient while you locate the area over the cricothyroid membrane to make an incision.

d. The cricothyroid membrane is the best place to make an emergency surgical airway. It is just beneath the skin in the middle of the front of the neck. It is between the thyroid cartilage ("Adam's apple") just above it and the less prominent (in males) cricoid cartilage below it. See figure 3–2 for location of incision site.

e. While immobilizing the skin and trachea with one hand, make an incision horizontally over the cricothyroid membrane through the skin. Then make a second incision into the larynx through the membrane until a finger-sized opening is obtained.

f. At this point, the patient should make a gasping inhalation through the opening which you have made. Enlarge the opening enough with your fingers to allow complete filling of the lungs. Let the patient breathe through the opening until he is partly stabilized while you assist by stretching the opening.

g. Insert a cannula or a tubelike item into the opening. Secure the cannula in the trachea, as in figure 3–3, to prevent it from being aspirated or dislodged. Any tubelike item may be used, including the barrel of a ball-point pen.

h. Place the patient in a position most comfortable to him.

i. If the patient does not breathe on his own, apply positive pressure respiration to the airway.

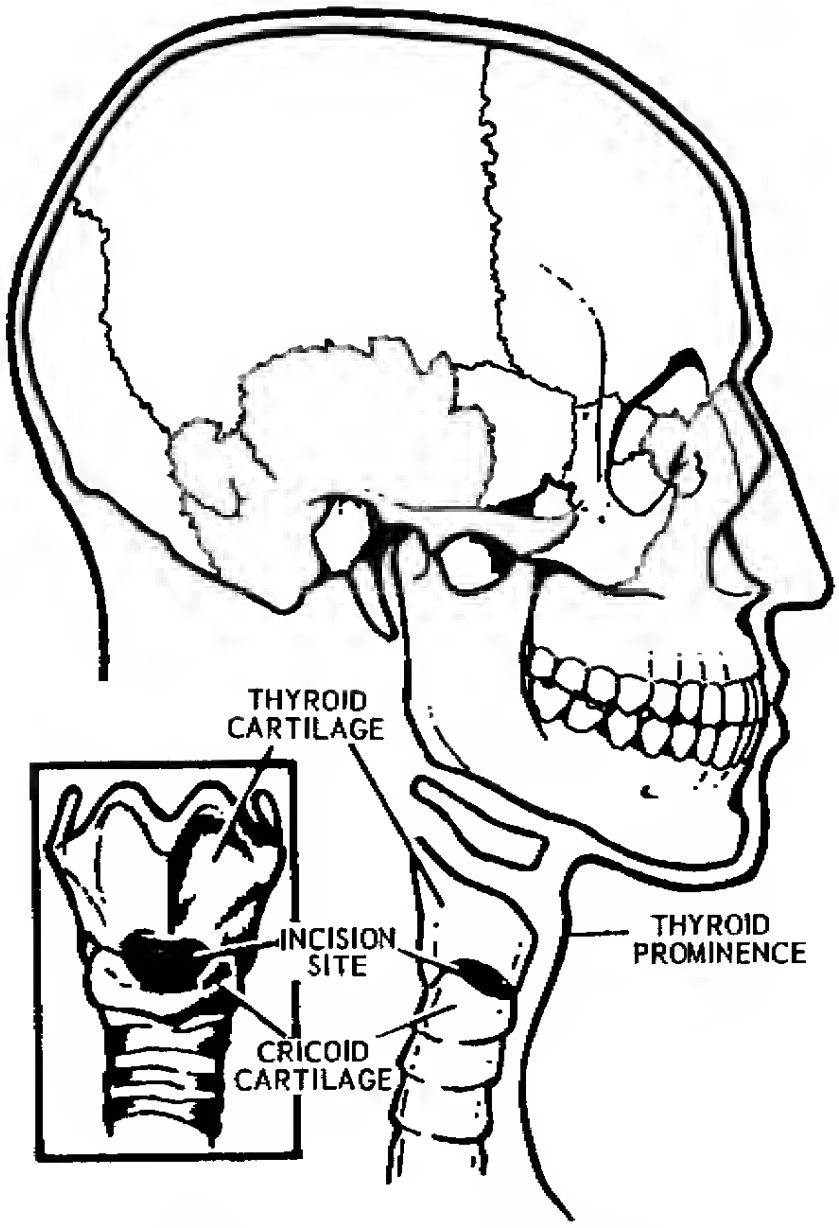


Figure 3–2. Site of incision for cricothyroidotomy.

3–11. Cardiac Arrest (Heart Stoppage)

Cardiac arrest, or heart stoppage, may be caused by insufficient oxygen supply to the heart or the brain, blockage of blood vessels of the heart, heart disease, foreign particles in the bloodstream (embolism), or overdosage of some drugs. Respiratory arrest is the most common cause of cardiac arrest. The heart will stop within minutes after breathing ceases.

Figure 3–3. Cannula inserted and secured in trachea.

a. Signs and Symptoms.

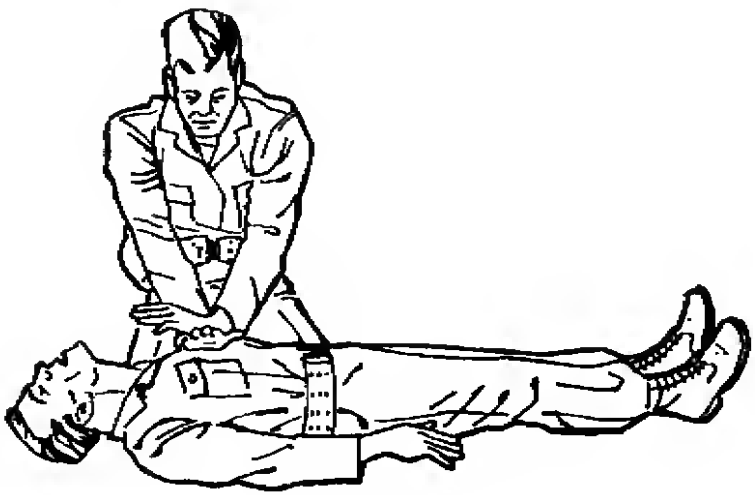
(1) Absence of a carotid pulse.
(2) Cessation of breathing.
(3) Dilated pupils of the eyes.
(4) Unconsciousness.
(5) Limp body and flaccid skin.
(6) Cyanosis.

b. Actions to Take Immediately.

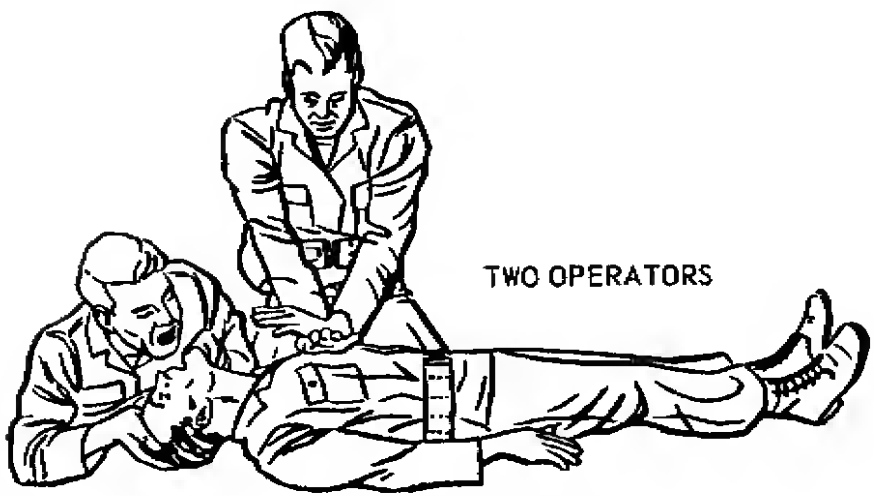
(1) Roll the victim onto his back.
(2) Check his airway and remove any obstruction.
(3) Hyperextend the neck and lift the lower jaw for mouth-to-mouth artificial respiration.
(4) Give him five quick puffs of air by mouth-to-mouth.
(5) Place the heel of your hand on the lower half of the sternum and press down until the sternum is depressed about 2 inches, as in figure 3–4①. Repeat this compression about 15 times, about 1 per second.
(6) Return to mouth-to-mouth artificial respiration and give the victim two respirations.
(7) Repeat this 15–2 cycle until help arrives or you are certain the patient is dead.
(8) If help is available, one person should give the cardiac compressions and the other should give mouth-to-mouth artificial

respiration as in figure 3–4②. The ratio with two operators should be about five compressions to one artificial respiration. The compressions should not be interrupted, even for the respirations. When respiration is being applied, the compressions must be stopped momentarily.

(9) The cardiac compressions should equal about 60 per minute, the respirations about 12 per minute.



ONE OPERATOR



TWO OPERATORS

Figure 3–4. Cardiac compression applied by one operator and by two operators.

3–12. Shock

Shock is a complex subject, but basically it means that the body tissues are not getting enough blood. The most common cause is hemorrhage where blood escapes from the vascular system and consequently does not get to the tissues.

a. Diagnosis. There are four broad areas of symptoms in shock. The first involves feeling the pulse, which is usually abnormally rapid. There is also a drop in blood pressure which is detectable by a weakened pulse. The second area is increased respiratory rate—the body's response to the lack of oxygen in the tissues. The third area is the skin which is usually cool and clammy and pale due to decreased blood flow. The fourth is changed mental state. In early shock, the patient frequently is agitated and restless. As the shock worsens and the brain is deprived of blood, drowsiness and unconsciousness result. In addition to these considerations, certain wounds are commonly associated with shock. When these wounds are present, treatment for shock should be begun even before the clinical signs and symptoms appear. These wounds include:

(1) Any wound which penetrates the belly, chest, neck, or pelvis. Internal bleeding is a likely possibility.

(2) Any wound of the arms or legs which has damaged a portion of tissue at least as big as a fist. Many bullet wounds of the thigh are in this category.

(3) Any wound which includes a fracture of a large bone. Blood loss of at least 1 quart frequently accompanies a fractured femur, for example.

(4) Any wound which results in blood loss of 1 quart or more. The blood may be visible on the ground, for example. If the blood has completely soaked a standard field dressing, this indicates loss of nearly a quart into the dressing. Treatment for shock is indicated. (A useful experiment you might try is to pour water into a dry field dressing to see how much water it takes to saturate it.)

b. Treatment. First, stop the bleeding and insure that the patient is breathing adequately. Position the patient on his back with his head down to enhance the flow of blood to the brain. Immediately begin intravenous (I.V.) fluid therapy, preferably through at least two veins. Administer fluids cautiously in the presence of possible intracranial injury. Make sure the patient is comfortable and reassure him. This can help prevent worsening of the shock.

c. Available Intravenous Solutions. Figure 3–5 shows several intravenous solutions and an intravenous injection set. One way

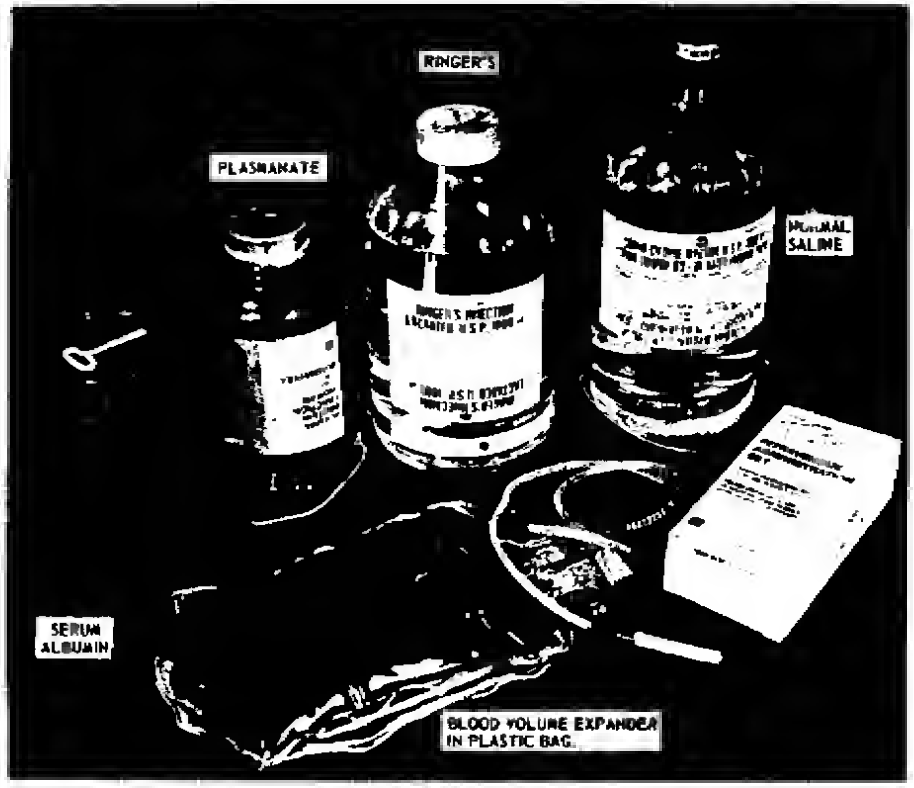


Figure 3–5. Blood volume expanders and infusion set.

of carrying bottles—in canteen covers—appears in figure 3–6. Solutions available to you include the following:

(1) Ringer's lactate solution (lactated Ringer's injection) is the most commonly used volume expander for treating hemorrhagic shock when blood is not available. It is a sterile solution of calcium chloride, potassium chloride, sodium chloride, and sodium lactate in water for injection. Its composition is closer to that of the extracellular fluid than is that of any other solution employed as a fluid and electrolyte replenisher. It expands the extracellular fluid volume which includes the blood volume. Ringer's solution is normally supplied in 1,000 cc. bottles but it can be procured in 500 cc. plastic containers.

(2) Normal saline (sodium chloride solution) is the second most commonly used intravenous fluid replacement. It can be used interchangeably with Ringer's lactate solution and is also an expander of extracellular fluid volume.

(3) Plasmanate is derived from human plasma which has been heat-treated to kill the hepatitis virus, and diluted to 5 percent strength in a solution similar to saline. Plasmanate is rich in albumin and tends to remain in the blood vessels; thus, it is a

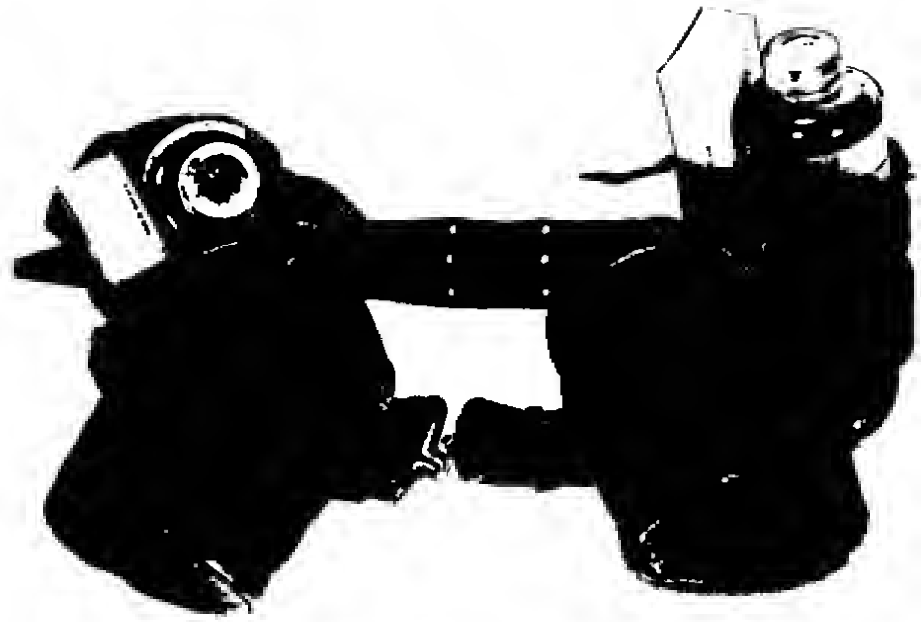


Figure 3–6. Blood volume expander carried in canteen cover.

plasma expander. It is an excellent replacement fluid for shock. It is supplied in 500 cc. bottles.

(4) Serum albumin is a concentrated protein in a small volume of water. It is useful in treatment of shock primarily if given with saline or Ringer's lactate. Used alone, it attracts water from within the cells and tissue spaces into the bloodstream. This may be dangerous, especially if the shock is due to dehydration, as in severe diarrhea. It is usually supplied in 100 cc. vials.

d. Use of Fluids in Hemorrhagic Shock. Blood is the best volume expander. It should be used in preference to anything else to treat shock due to hemorrhage. To avoid a reaction, only the proper type of blood should be given. You may not have either the blood or the facilities for typing it. As rapidly as possible, get the patient to where these facilities and blood are available. Meantime, start rapid replacement (two intravenous injections) with saline or Ringer's lactate. If plasmanate is available, use it instead. In an emergency, when evacuation will be delayed several hours, oral saline solution can be of great benefit if the patient does not have an abdominal wound and if he is fully conscious. Mix the salt and soda packet from your aid bag in the coolest potable water you can get. Encourage but do not force the patient to drink it. If he vomits, go slower, and keep trying to have him drink it. Usually he can keep down most of it. If you are isolated overnight with a patient who has a 50 percent burn, 7 to 10 liters (or quarts) of oral saline may keep him alive.

CHAPTER 4

WOUNDS: CLASSIFICATION, STABILIZATION, AND EVACUATION

4–1. Classification of Wounds

For treatment and recording purposes, wounds are classified by cause, type, or appearance.

a. Classification by Cause.

(1) *Bullet wounds.* These wounds differ according to the type of weapon that fires the bullet. Damage to underlying tissue is affected by the size of the bullet and the velocity of the bullet as it strikes the patient.

(2) *Fragmentation wounds.* These are wounds made by fragments of exploding grenades, mortars, mines, booby traps, rockets, bombs, and artillery rounds. The explosion throws bits of metals in all directions, often causing multiple wounds of varying sizes.

(3) *Wounds due to falls.* A fall while a soldier is taking cover, especially with a pack on his back, can cause twisting, tearing, or wrenching wounds. A fall from a moving vehicle may result in broken bones and bruises.

(4) *Burns.* Burns can be caused by many sources. The ones encountered most frequently are napalm weapons, flame throwers, gasoline, white phosphorus grenades, or marking rounds. Burns are discussed in detail in paragraph 5–10.

b. Classification by Appearance.

(1) Bullets and shell fragments make penetrating wounds, perforating wounds, or both. A penetrating wound is one in which the bullet or fragment enters but does not leave the body. Knife or bayonet wounds also are included in this category. A perforating wound is one in which the bullet or fragment goes all the way through the body and makes at least two wounds, one of entrance and one or more of exit. The exit wound is often larger than the wound of entrance and may be located in an area of the body distant from the entrance wound. Therefore, every patient with a bullet wound must be examined thoroughly to see if he has more than one wound.

(2) A laceration is a cut or a tear. Unless they involve major blood vessels or impair breathing, lacerations are not a special

lifesaving problem for the aidman. Since they can be large and appear nasty, they may make the patient apprehensive. Usually there is more fright than pain with a laceration. The main problem with a lacerated wound incurred in combat is that it becomes infected easily. To prevent infection and to promote growth of new tissue, the wound must be debrided. The process of debriding, or debridement, is the surgical removal of all dirt, contamination, and dead tissue. This procedure must be done at a treatment facility under sterile conditions. After debridement such wounds are often left unsutured for a few days. The procedure, called "delayed primary closure," or "DPC," prevents infection and permits better healing. All combat wounds, regardless of size, are considered contaminated and should receive delayed primary closure.

(3) A closed wound is one with internal damage to bones or tissue without a connecting wound in the outer skin. Sprains, strains, dislocations, and certain fractures are closed wounds.

4–2. Relief of Pain

Some pain occurs after most wounds. Pain may be mild or severe, depending upon the patient and the wound. The patient's state of mind at the time of wounding will have some effect on the degree of pain. Fear and apprehension, for example, make it worse. To some patients the fear of pain is more real than the pain itself. You must decide whether or not the relief of pain is in the best interest of the patient. In many cases, pain is a helpful symptom to medical personnel. Pain is nature's alarm system; silencing it may be detrimental to the patient.

a. You can give him some relief in these ways.

(1) *Positioning.* The best position is the one which the patient finds most comfortable. Positioning the injured part to relieve stress can do much to relieve pain.

(2) *Reassurance.* Talk to him reassuringly. Make him feel that he is in good hands and more help is on its way. The best type of reassurance is for you not to panic and to act as if everything is under control.

(3) *Medication.* Administer an analgesic such as aspirin or APC. If oral medications and fluid are not contraindicated, aspirin is an outstanding drug and will relieve all but the most severe pain.

b. If the pain is extremely severe, you may have to give morphine if it is not contraindicated (para 4–3*d*).

4–3. Use of Morphine

a. Morphine is the best pain relieving medicine you have, but it has several dangerous toxic effects. It is a powerful depressor of the central nervous system, greatly reducing respiration and pain sensation. Also it causes vomiting, dry mouth, constipation, and retention of urine. It must not be given by anyone who is not fully aware of its dangers. Never let morphine out of your possession. It may be stolen for personal use or sale on the black market.

b. Morphine is supplied to you in 16 mg. (one-fourth grain) syrettes. The number of syrettes you carry is determined by your medical commander on the basis of the tactical situation, availability of evacuation, supply, and your ability to administer it intelligently. You must know the indications and contraindications for its use. If not you may do more harm than good. (Contraindication is any condition which makes a particular treatment undesirable or improper.)

c. Morphine is *indicated* for severe pain especially when the evacuation lag time is more than 20 minutes. In a tactical situation where a psychotic patient must be temporarily silenced or sedated, and no other tranquilizers are available, one syrette of morphine is often effective in controlling such a patient. This is an emergency measure only. There are better, nonaddicting drugs for psychosis than morphine.

d. Morphine is *contraindicated* when its toxic effect will compound an injury to a dangerous degree. Do not give morphine to: patients who are to be quickly evacuated, who have chest injuries, depressed respiration, or injuries of the head. Never give morphine to an unconscious patient. Do not give morphine before surgery. If there is a probability that the patient may soon be operated on, he should not get morphine. Both morphine and surgical anesthesia depress respiration. If the patient is in shock, you should not give him morphine because it will not be absorbed due to poor circulation. (Medical officers sometimes administer morphine intravenously while the patient is in shock. Never should you try to give morphine intravenously. If it is given too fast it will be fatal.) A dose of morphine should not be repeated within 2 hours, or if there is any reason to believe the first dose has not been absorbed.

4–4. Treatment of Open Wounds

Control of hemorrhage, relief of pain, and prevention of infection are the main considerations in treating wounds in the field.

a. Acute loss of blood may lead to shock, and shock may lead to death. So, you should do all you can to prevent loss of blood. The preferred method of controlling bleeding is with a pressure dressing securely applied. Lost vascular fluid (blood) or body fluid (tissue fluid) should be replaced. Use oral or intravenous fluids as prescribed in paragraph 3–12.

b. Some wounds are more painful than others. In some traumatic amputations there may be relatively little initial pain, while

in smaller wounds the pain may be severe. Second degree burns and massive tissue wounds involving many nerves are initially painful. Nearly all wounds cause some pain. Things you can do to relieve pain are described in paragraphs 4–2 and 4–3.

c. Any combat wound must be considered contaminated. The best way to prevent more contamination is to cover the wound with a sterile dressing. Combat wounds are "dirty" wounds. All contain bacteria. In the field, there is no way for you to cleanse a wound of bacteria. Pouring antiseptics into a wound will not kill all the bacteria and may be harmful. Pouring antiseptics on the skin around a wound does little to keep out bacteria and should be avoided. When possible, and when evacuation is impossible or delayed for longer than several hours, gentle cleansing of the skin around the wound with soap and water may be helpful.

4–5. Factors Affecting Infection

Infection of a wound involves the number and type of pathogenic organisms entering the wound, condition of tissue in the wound, and the body's defense.

a. If the number of organisms is extremely large, they may overwhelm the body's defense by sheer numbers. This is likely to happen in wounds caused by booby traps with filth and contamination about them. Punji stake wounds are another example.

b. Some organisms are more toxic than others. For example, the organisms that cause gas gangrene and tetanus are deadlier than some organisms that form pus.

c. A cleanly cut wound is not as apt to become infected as a torn, jagged wound. In the first type of wound, blood tends to flush out organisms and they have few places to hide and become imbedded. The second type of wound gives organisms devitalized tissue to hide in and has much less flushing action by bleeding. A puncture wound is most likely to become infected with tetanus and gas gangrene because of lack of oxygen. Penetrating and perforating wounds are usually heavily contaminated by foreign material carried into deep parts of the body. Penetrating abdominal wounds often permit contaminated intestinal contents to leak into the cavity.

4–6. Treatment of Closed Wounds

a. Sprain. A sprain is the twisting, tearing, and stretching of ligaments around a joint. Ligaments are strong, slightly elastic, fibrous bands of tissue that hold bones in position. A ligament can be over-stretched and some of its tissue cells injured, or it can be torn loose from its attachment to the bone. An injured ligament heals slowly and sometimes never entirely returns to normal. Diagnosis is made by the presence of a tender, painful joint with swelling. Fracture also must be considered a possibility with these findings.

(1) A sprain is treated so as to temporarily replace the function of the ligaments by supporting the joint while allowing some movement. You carry elastic rolled bandages for this purpose. A figure-of-eight bandage around the joint should allow the patient to complete his immediate mission. The bandage should be adjusted as swelling occurs. Have a medical officer evaluate the patient after mission.

(2) Analgesics may be given for pain.

(3) Routine evacuation may be indicated.

b. Strain. A strain is an overstretching of a muscle or the muscle's tendon. In combat, some muscles will be forced to function long after they are tired. This results in acute muscle fatigue or muscle strain. Diagnosis generally involves finding tender, painful muscles. Swelling is uncommon.

(1) There is little you can do to treat a strain in the field. The patient needs rest with just enough exercise to keep the muscle from getting too stiff. You cannot provide this type of treatment in the field.

(2) Analgesics may be given for pain.

(3) Heat and massage are also very helpful.

(4) If the strain is severe, routine evacuation is indicated.

c. Dislocation. A dislocation is the displacement of one of the bones forming a joint. A joint is the articulation of two or more bones. When one end of a bone forming a joint is forced out of its articulation, it is dislocated. The dislocation may be incomplete and temporary. In other words, it may jump out of and back into normal position, resulting in a condition much like a sprain. If the bone dislocates from its articulation and remains out of place, it is a complete dislocation. Damage to surrounding blood vessels and nerves may result.

(1) You should not try to reduce a complete dislocation in the field.

(2) Analgesics should be given for pain.

(3) Immobilization of the joint in the position of least pain may be helpful. Usually that is the position in which you find it.

(4) Routine evacuation is indicated unless damage to blood vessels or nerves is suspected because of paralysis, numbness, or absent pulse. In that case, priority or even urgent evacuation may be necessary.

d. Fractures. For treatment of fractures, see paragraph 4–7.

4–7. Fractures

Fractures, or broken bones, are the result of a strong blow or stress against the body causing one or more bones to crack or

break completely. Fractures are either closed (no break in the skin) or open (skin broken). Open fractures are generally more serious, because of the danger of infection.

a. Diagnosis. The patient with a broken bone is almost always in pain at the fracture site. He will give a history of trauma or stress and often will state that he felt the bone snap or give way. He typically has great difficulty in moving the part of the body beyond the fracture. As you examine the patient, you will find swelling and tenderness at the fracture. The broken limb may be obviously deformed. Ultimately, X-rays will be needed to establish the diagnosis and extent of the fracture.

b. Treatment. As with any wounded patient, the first thing to do is save his life. Make sure he has a clear airway and can breathe. Stop external bleeding. Almost every fracture is accompanied by significant internal bleeding. A fractured femur, for example, may involve loss of as much as 1,500 cc. of blood into the thigh. Plainly, then, a patient with a fracture of a major bone is in danger of developing hemorrhagic shock. Therefore, intravenous solutions should be started as soon as possible on any patient with a fracture of a major bone. Place a dry sterile dressing over the wound if it is an open fracture. Administer analgesics for pain. The patient must be evacuated, but the category depends upon the seriousness of the fracture.

c. Splinting. Do not attempt to reduce or set a broken bone. In general, splint the fractured limb as you find it, checking the pulse beyond the fracture before and after splinting. If the pulse disappears after the splint is applied, it is on too tight and must be loosened. Also a record of nerve function distal to the fracture should be made. If the fractured limb is bent so that it pinches off the blood vessels, you may straighten it carefully as long as no force is needed. Never try to force an arm or a leg to lie straight. Splinting is extremely valuable because it prevents further damage to surrounding tissues by the broken bones. Also, splinting helps to reduce bleeding and pain.

d. Splints. Splints and splinting in the field will pose some problems. You do not carry splint sets, such as the Army leg splint set. You may carry the wire fabric splint. Some aidmen carry two wire ladder splints wrapped around the outside of the aid bag as in figure 4–1. To support missions where fractures might occur, you may carry a few pneumatic splints. The ones used most in the field are improvised and anatomical splints (fig 4–2).

(1) An improvised splint is made of any rigid material that is readily available. Parts of the patient's gear are often the handiest material you can use. Rolled or folded, the patient's poncho makes a good splint. So does his rifle when rolled in a jacket. (Be sure the rifle is cleared.) Poles or branches from trees also can be used to make splints.

Figure 4–1. Wire ladder splints wrapped around an aid bag.

(2) How much time you can spend on improvising a splint will depend upon the tactical situation. There may be instances where you have no time to improvise a splint. In that case, for a fracture of the forearm, quickly place the arm inside the jacket and tuck the jacket as tightly as possible. A fracture of the upper arm could also be treated this way or with a sling around the neck to the wrist. For a fracture of the leg, quickly tie the broken leg to the uninjured leg. This is an example of an anatomical splint, where one part of the body is used to help immobilize another part.

(3) The wire fabric splint is useful in supporting a massive tissue wound. It can be fashioned to help support a broken ankle, wrist, or small bone.

(4) The wire ladder splint can be used for a fractured arm or leg or to support a massive tissue wound. You should control the bleeding before applying a splint. If not, put on the splint so it can be removed easily and quickly.

(5) A pneumatic splint (fig 4–3) is inflatable and made of transparent plastic. You blow air into it by mouth to get the necessary rigidity. Do not use any other means for inflation (such as a tank of compressed air). The splint requires no padding and it can be inflated or deflated as desired. The splint should not be

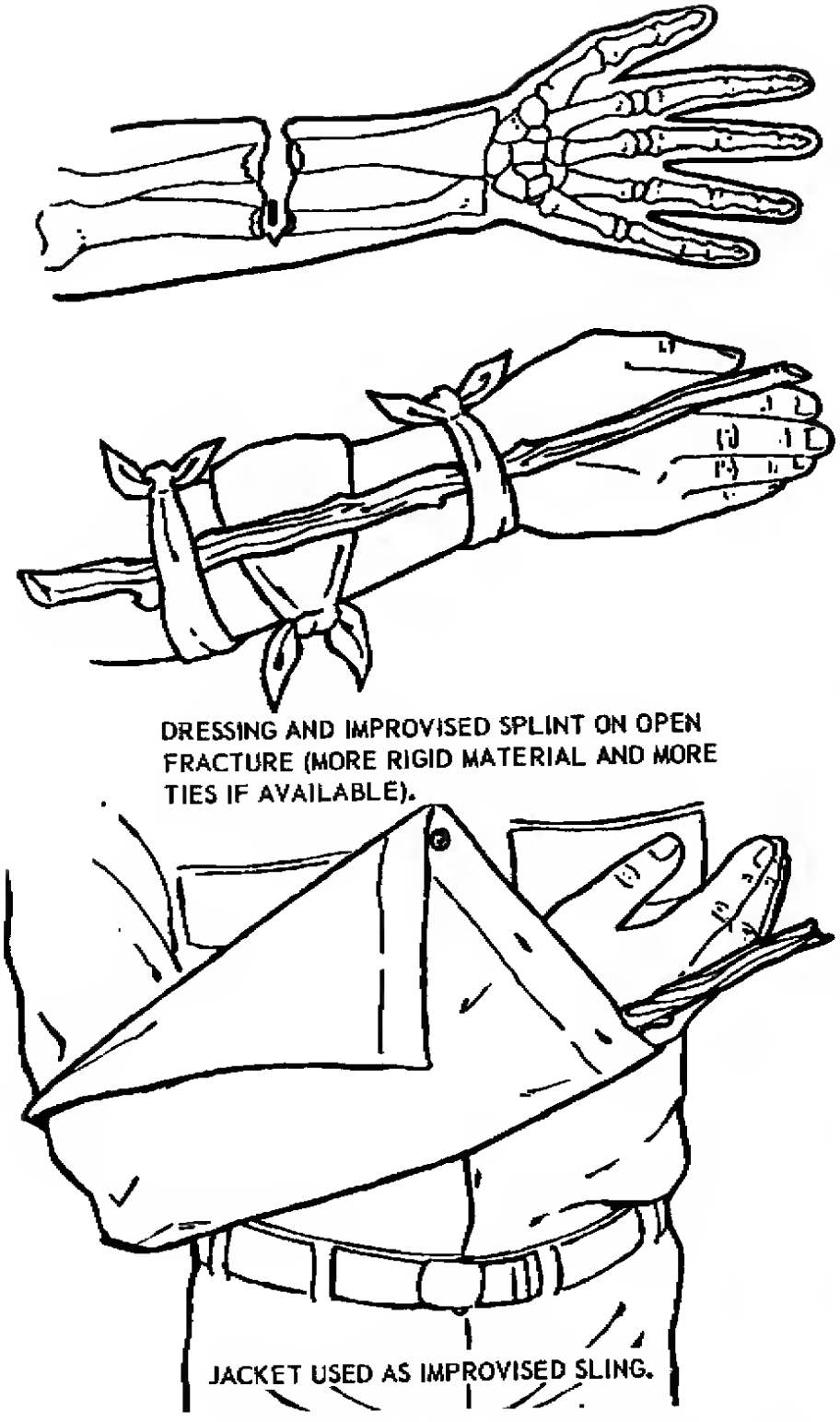


Figure 4–2. Examples of improvised and anatomical splints.

inflated and left on the patient more than 30 minutes at a time. To do so will interfere with peripheral circulation. Reduction of peripheral circulation for a long time causes tissue anoxia, which in turn results in damaged or necrotic tissue. Tissue damage is proportional to the duration of diminished peripheral circulation and the degree of tissue anoxia. Therefore, if the patient must wear a pneumatic splint for an extended time, partially deflate it every 20 to 30 minutes for a few moments to reestablish peripheral circulation if it appears that the blood supply to the extremity has been impaired. Do not use these splints unless you have time to check the patient every few minutes.

(6) Army leg splint sets are stocked at aid stations, clearing stations, dispensaries, hospitals, and medical depots. If time and the tactical situation permit, you may ask the evacuation vehicle operator to bring you an Army leg splint if its application is indicated. This splint is especially valuable in protecting the nerves and blood vessels.

4–8. Dressings

A dressing is a pad that is applied directly over a wound. A prepared dressing is usually made of gauze but it can be made of any

Figure 4–3. Inflated pneumatic splint applied on a patient's arm.

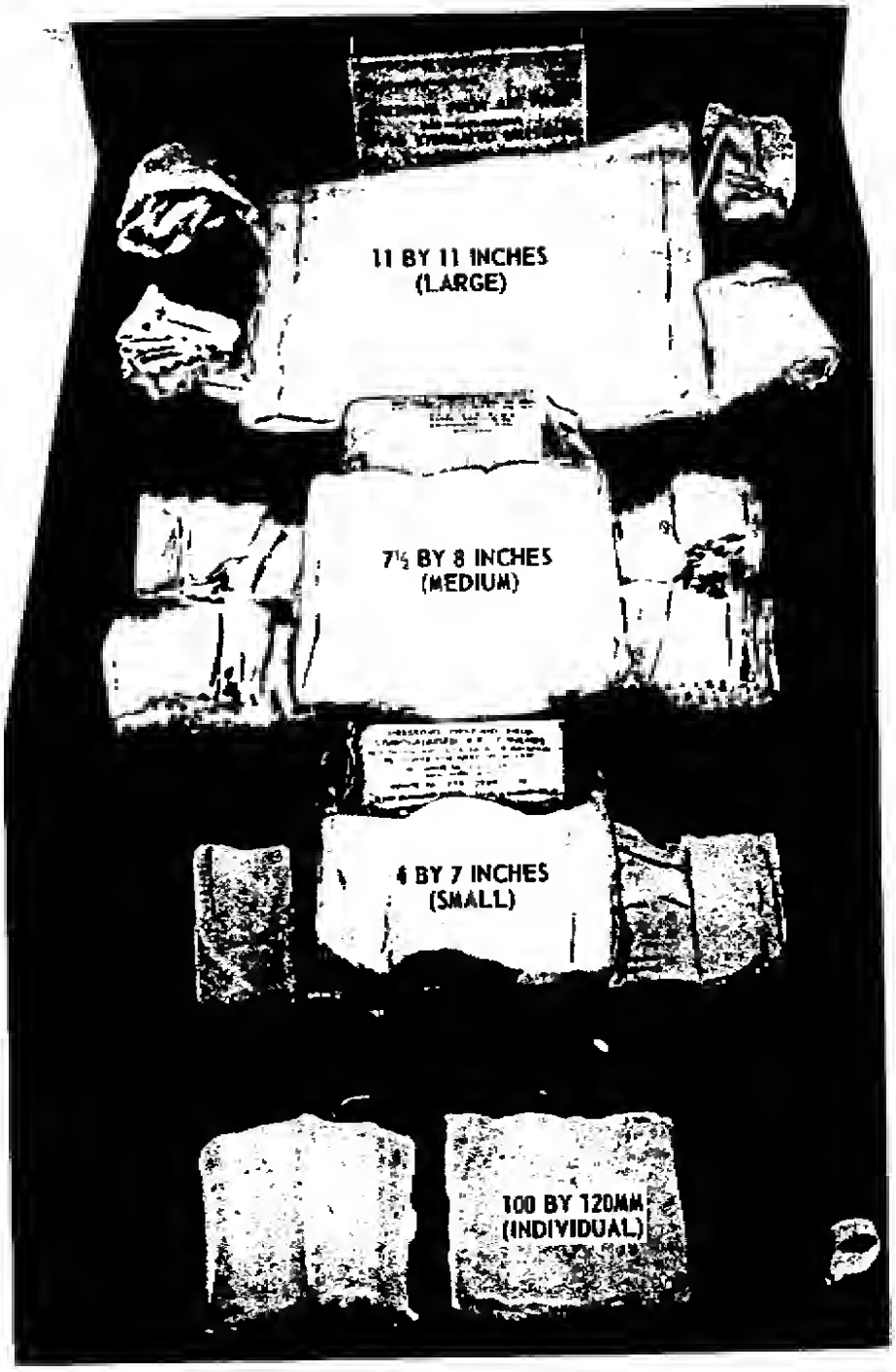


Figure 4–4. Popular sizes of field dressings.

is to control hemorrhage and protect a wound against further contamination. Almost all external bleeding can be controlled with a correctly applied field dressing.

a. Sizes. The most popular sizes of field dressings, shown in figure 4–4, are described below.

(1) *Dressing, first aid, 4 by 7 inches.* This small field dressing is the one you probably will use most. You should carry a plentiful supply of these. Many aidmen carry two aid bags, one filled with dressings and one containing other items. Be sure each soldier carries at least one small field dressing.

(2) *Dressing, first aid, field, 7½ by 8 inches.* This is usually called the medium field dressing. The average aidman carries two of these. They are used often to reinforce the small field dressing.

(3) *Dressing, first aid, field, 11 by 11 inches.* This is the large field dressing. You usually carry one of this size. Most aidmen prefer to carry more small dressings and use two or three small ones instead of one large dressing. You can contour two or three small dressings better than a large one. Large dressings are best for extensive burns.

(4) *Dressing, first aid, field, individual troop, 100 by 120 mm.* This is a two-piece dressing designed to allow one gauze pad to slide along the affixed bandage. One purpose of this adjustable dressing is to allow application of the dressing over a perforated wound of an extremity to cover the wounds of entrance and exit with the same dressing. This dressing is smaller and more versatile than other field dressings.

b. Application. A field dressing has strips of gauze bandage attached to it. The gauze strips or tails are used to secure the dressing and to apply pressure. First, put a small dressing over the wound and tie the bandage tails firmly over the dressing to apply pressure. If the first dressing does not control bleeding, apply a second one over it. Again, tie the bandage tails firmly. Several small dressings are more effective than one large dressing for controlling hemorrhage.

4–9. Bandages

A bandage is a piece of material used to cover a dressing, apply additional pressure, or immobilize a part of the body. Bandages may be made of gauze, muslin, or elastic cotton (fig 4–5). They may be rolled or folded. Most aidmen prefer to carry a few elastic rolled bandages about 3 inches wide. Elastic bandages are used to reinforce dressings in the control of hemorrhage and to support ankles and knees. Rolled gauze bandages are not often used in the field. Triangular muslin bandages are sometimes used for support but are used most as tourniquets. Folded triangular bandages (cravats) are useful in applying improvised splints.

Figure 4–5. Bandages for field use.

CHAPTER 5

SPECIFIC WOUNDS AND BURNS

5–1. Classes of Head Injuries

Head injuries are of two main classes, open wounds and closed wounds. They are further classified as scalp wounds, skull fractures, intracranial wounds, and wounds of the face.

5–2. Scalp Wounds

a. Laceration of the scalp may result in a gaping wound with profuse bleeding. The wound is gaping because of the tension of the layers of the scalp. The profuse bleeding is due to the rich blood supply. Firm pressure dressings will control bleeding of the scalp.

b. Contusions resulting from blows to the head may form lumps in the scalp. These are usually collections of blood caused by broken blood vessels within and under the scalp. Contusions require no specific treatment by the aidman in the field, but all head wounds should receive careful examination and constant observation. A patient may have no complaint other than a slight headache immediately following the injury, even though serious intracranial damage may exist.

5–3. Skull Fractures

Cranial wounds are skull fractures. A skull fracture may be a simple line break or crack in the skull bone, or it may be a depressed fracture with pieces of the skull penetrating the brain. A simple skull fracture in itself is not serious as the bone will heal fairly rapidly. The danger is that the blow which caused the fracture also ruptured blood vessels under the skull, causing blood to collect and increase pressure on the underlying brain tissue.

a. Generally, you will be unable to determine whether a skull fracture is present or not. Sometimes the fracture can be felt through the scalp, but most skull fractures will not be proven until X-rays are taken. Consequently, you should suspect skull fracture in any patient who received a severe blow to the head, even if the scalp was not lacerated. If you see clear fluid coming from an ear, the nose, or a head injury, or if you see brain matter in any head wound, you can be sure a skull fracture is present. In

addition, pupils of unequal size and vomiting are signs of brain injury even if the skull is not fractured.

b. Do not give medication to a patient with a head injury. The medication may mask the symptoms of a more serious injury. Observe the patient carefully, paying particular attention to his vital signs and state of consciousness.

c. Routine evacuation is indicated for simple head injuries if there is no firm evidence of skull fracture and the vital signs and state of consciousness are stable.

d. If you can feel a fracture, or if you see the clear cerebrospinal fluid coming from the patient's nose, ears, or wound, or if you see brain matter in the wound, or if the vital signs or level of consciousness deteriorate, evacuate the patient by the proper category of precedence. In this case, that would be probably priority or urgent. If an external wound is present, apply a loose-fitting dressing. Again, give no medication.

e. The most important thing you can do in the treatment of head wounds is record the injury. Record the time of the wounding and all signs and symptoms. Make particular note of vital signs, size of pupils, and state of consciousness both when you first began treatment and at the time of evacuation. Also record the time of your observation.

5–4. Intracranial Wounds

Intracranial wounds are serious because they involve the brain and other tissue inside the skull. There are two general types of intracranial wounds, open and closed. In the open type, the brain is exposed to the outside and there is a laceration of the scalp as well as a skull fracture. In the closed type, there is no opening from the brain to the outside. Either type will pose problems for you. For a severe open head wound, you should apply a dry, sterile dressing and call for immediate evacuation using the urgent category of precedence. The closed head wound poses special problems. You have no immediate way to determine the degree of injury. Therefore, you should do the following things:

a. Observe the patient closely.

b. Record the time of the injury.

c. Check the patient every few minutes for headache, changes in size of pupil of the eyes or in their reaction to light, impairment of vision, dizziness, slurring of speech, changes in pulse rate, vomiting, or changes in rate of respiration. Be sure to record these symptoms and the time of their onset. They indicate that brain injury is developing, usually from slow bleeding inside the skull. Always record at least one observation of pupil size and pulse rate in case of a head injury.

d. Request a priority category evacuation for the patient if any of these symptoms appear.

e. Advise the patient's commander not to plan on using the patient for critical or sensitive duties while he is being observed.

f. Give no medication during the period of observation. Observation should last about 24 hours. Occasionally the bleeding inside the skull can be very slow, with the symptoms taking several days to develop. The patient's commander should be altered to this possibility.

5–5. Wounds of the Face

Facial wounds require prompt, positive action because of bleeding and possible airway obstruction. Airway obstruction is a more immediate threat to life and harder to handle than bleeding. Blood clots and pieces of bone, flesh, or other foreign material may block the airway. Blood which is swallowed may cause vomiting and the vomitus may be aspirated, further complicating the problem. Attempts to control bleeding may interfere with breathing. The patient may be trying frantically to get air. Do these things immediately.

a. Position the patient so that he will not aspirate fluids if he is bleeding from the mouth or vomiting.

b. Clear the airway of blood clots and foreign matter. Wrap a piece of gauze bandage around your fingers when you dislodge blood, vomitus, or mucus from the airway. Gauze makes it easier for you to grasp things.

c. Prepare to perform an emergency surgical airway. Due to aspiration of foreign matter, the patient will be hard to manage and he will remain in danger of aspirating more foreign matter until bleeding is controlled. It may become necessary to perform an emergency surgical airway (para 3–10) to relieve airway obstruction before full attention can be turned to control of bleeding from the facial wound.

d. Call for evacuation early. Facial wounds become progressively worse. Airway difficulties get worse with swelling of injured tissue. Bleeding is hard to control, injured tissue becomes more painful, and it is almost impossible to prevent infection. Collect all pieces of dentures, if any, and evacuate them with the patient. They can be valuable aids in treatment and reconstruction.

5–6. Wounds of the Neck

Wounds of the neck are treated essentially the same as facial wounds. Airway obstruction and hemorrhage are the main threats to life. Hemorrhage from large blood vessels must be controlled quickly. Direct pressure with a pressure dressing must be applied

over the bleeding point, alongside but not over the trachea. Take these actions or precautions immediately.

Caution. Beware of a possible fracture!

a. Position the patient quickly to prevent more blood from entering the airway.

b. If large blood vessels are severed, apply direct pressure quickly.

c. Call for assistance; the patient will be difficult to handle.

d. Clear the airway as rapidly as possible. Consider a surgical emergency airway early.

e. Due to aspiration of large amounts of blood, the airway may be blocked. After clearing it, start artificial respiration if spontaneous respiration does not occur.

f. Call for evacuation early and request delivery of necessary resuscitative equipment.

g. In severe hemorrhage, start blood volume expanders promptly.

h. Handle the patient very gently if you suspect he has a fractured neck. Immobilize the neck as much as possible.

i. Do not give morphine.

j. Do not give anything by mouth, as the esophagus may be injured.

5–7. Chest Wounds

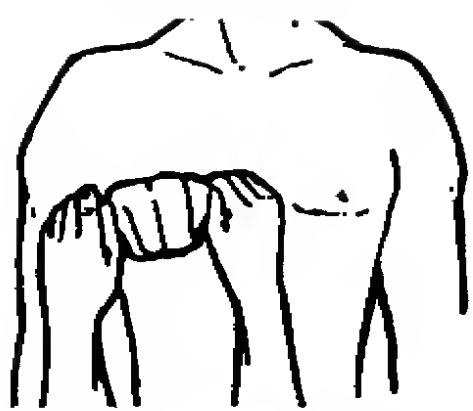
Chest wounds respresent an appreciable proportion of combat wounds. Most fire is directed toward the chest. Penetrating and perforating wounds of the chest may damage the lungs, trachea, bronchi, esophagus, diaphragm, or large blood vessels. Most chest wounds interfere with breathing.

a. The normal chest cavity is an airtight enclosure with one opening to the air, the trachea. If another opening into the chest cavity is made, such as a bullet wound through the chest wall, the lung on that side of the chest can no longer remain expanded and is said to "collapse." With each breath, air is sucked into the chest cavity, permitting the lung to deflate further. This is called a "sucking chest wound." The more the lung collapses the less well the patient can breathe. Therefore, the sucking chest wound must be *sealed* shut as soon as possible by any means available.

(1) The best way is to place several thicknesses of petrolatum-impregnated gauze over the wound and reinforce it with a field dressing, as in figure 5–1.

(2) A field dressing (first aid dressing) may be placed over the wound. Then, the dressing should be covered with airtight material to produce a quicker airtight seal over the wound.

(3) A piece of airtight material such as cellophane, plastics,



PETROLATUM GAUZE OVER SUCKING CHEST WOUND

DRESSING OVER PETROLATUM GAUZE

BANDAGE OVER GAUZE

Figure 5–1. Treatment of a sucking chest wound.

or poncho placed directly over the wound is effective as long as it is held firmly in place. These materials tend to slip and leak as blood seeps under them.

(4) All sucking wounds must be sealed. The test of successful sealing is in the patient's ability to breathe easier and the cessation of bubbling or hissing at the wound during respiration.

b. Flooding of the chest cavity by internal bleeding can also collapse the lungs. If all wound openings are closed and the patient still has difficulty, you can assume he has internal bleeding or massive lung damage. If the patient begins to present a shock picture, internal bleeding should be suspected. If he begins to hemorrhage from the mouth, he is critical. Then, the following measures are used.

(1) Place the patient in the best breathing position. If possible, the wounded side should be placed down to increase breathing of the unwounded side.

(2) Start intravenous infusions of Ringer's lactate solution or other blood volume expanders.

(3) Keep the patient as still as possible.

(4) Urgent evacuation is indicated.

5–8. Abdominal Wounds

A wound of the abdomen can be misleading. What appears to be a small, insignificant wound on the outside may be a massive, bleeding wound on the inside (fig 5–2). All penetrating and perforating abdominal wounds require exploratory surgery to stop bleeding. Abdominal wounds may include damage to the stomach, pancreas, intestines, spleen, liver, kidneys, or large blood vessels. The early cause of death is uncontrolled bleeding. Infections, especially those of the internal abdominal lining (peritonitis), caused by injury to the intestines or by the wounding agent itself, may complicate the case later.

a. Signs and Symptoms of Internal Abdominal Bleeding.

(1) Any perforating or penetrating abdominal wound.

(2) Pale skin and weak, rapid pulse.

(3) Thirst, restlessness, and apprehension.

(4) Abdominal rigidity (board-like).

b. Actions You Should Take Immediately.

(1) Instruct the patient to remain as still and quiet as possible.

(2) Call for urgent evacuation.

(3) Start intravenous infusions of Ringer's lactate solution or some other blood volume expander.

(4) If the patient's organs are protruding, do not try to replace them.

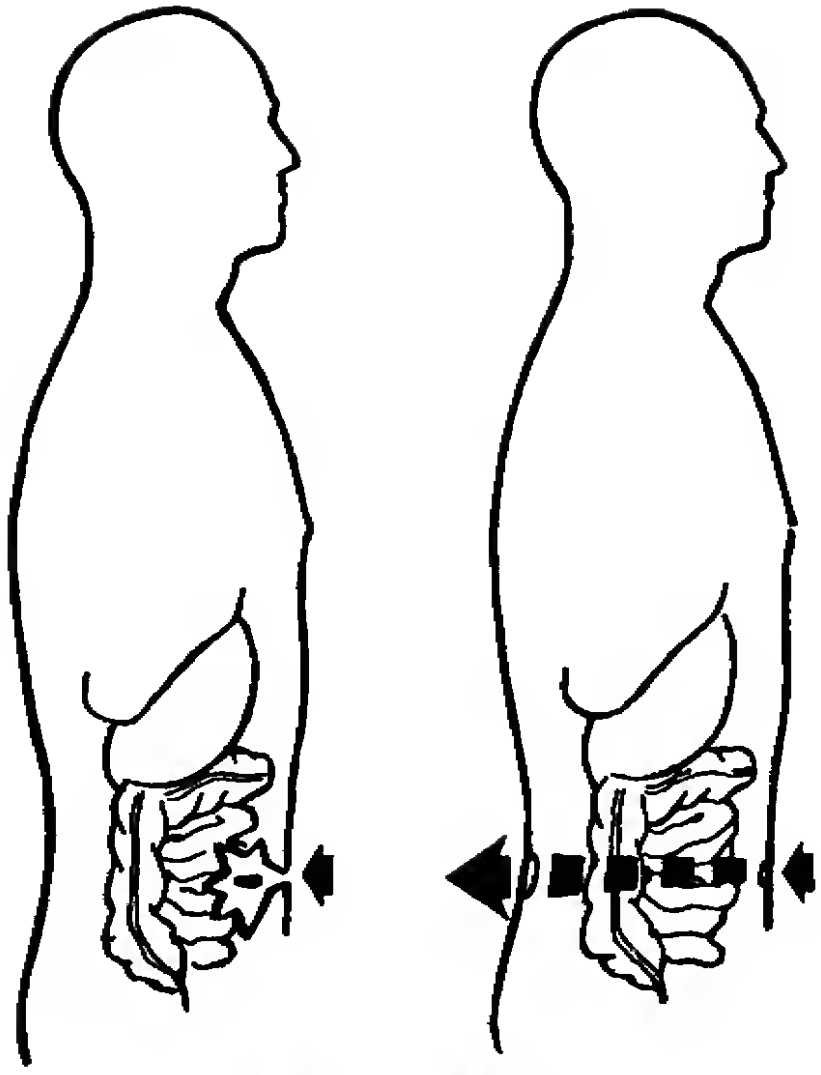


Figure 5–2. Abdominal wound.

(5) Cover the wound loosely with a dry sterile dressing.

(6) Allow the patient to take *no* food or drink by mouth. Give no oral medication.

(7) For a closed abdominal wound (blunt trauma), give no medication for pain because it might disguise the symptoms needed for diagnosis. If the wound is open and there is no breathing trouble or head injury, morphine may be given by injection for pain.

5–9. Traumatic Amputations

Most traumatic amputations are caused by exploding antipersonnel mines, land mines, and booby traps. Fragments thrown out by

any of these devices can amputate an arm or a leg. High velocity bullets can cause a partial amputation. In treating a patient with a traumatic amputation, you must do these things immediately.

a. Expose the entire limb above the wound by removing or cutting off the clothing. Inspect to confirm the extent of damage to remaining tissue.

b. Apply a tourniquet at once. Often, if the entire extremity is completely torn off, bleeding will be slight. This is due to the partial retraction of arteries and contraction of muscles acting like a tourniquet. Even if bleeding is slight, apply a tourniquet because, in a few minutes, the muscles will relax and bleeding will start.

c. The best field tourniquet is made with a cravat bandage and a stick. As in figure 5–3, place the tourniquet about 2 inches above the end of the stump or incomplete amputation. Tighten the tourniquet until all bleeding stops. Secure the tourniquet (fig 5–3) so that it is easy to remove or to tighten.

d. Cover the stump or incomplete amputation with field dressings. The dressings keeps the wound clean and gives you a visual check on bleeding. If the dressing becomes soaked with blood, check the wound or inspect and adjust the tourniquet. Do not apply a roller bandage at this time; it would interfere with the tourniquet.

e. If the amputation is incomplete, put a splint on it. The tissue splinted should be positioned in approximate anatomical alignment to avoid further damage to splinted parts of the limbs. Tissue below the probable amputation can be saved sometimes and used later in making the stump. A temporary improvised splint that is easy to remove is adequate. Apply the splint so that the tourniquet can be adjusted without much trouble.

f. At first, the pain should be slight to moderate. Severe pain may develop later, in 30 minutes to 2 hours. Morphine is not indicated unless the pain is severe.

5–10. Burns

Burns are damage to tissue caused by exposure to excessive heat, strong chemicals, or electricity. They are classified by cause, degree, and extent. All classifications should be considered in the treatment and disposition of a burn patient. Burns are complicated by airway blockage, carbon monoxide poisoning, lung damage, shock, and infections. Most people who die immediately in a fire die from suffocation. Those who die a few hours later usually die of shock. Those dying 3 to 10 days after the burn usually die of infection. Other factors complicate burns but you can do little in the field to prevent them. Your first job is to treat those life-threatening conditions which follow burns.

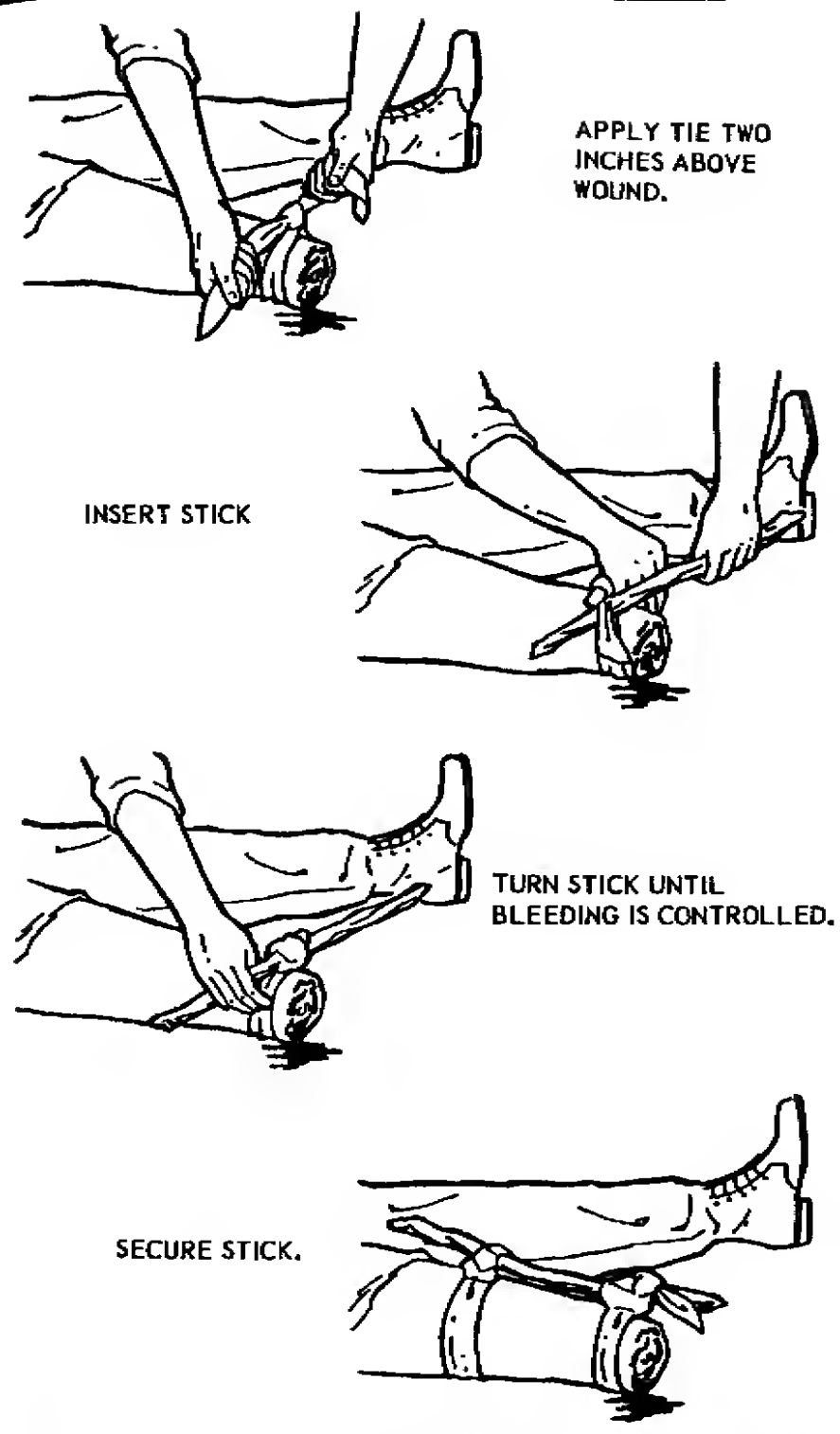


Figure 5–3. Application of Spanish windlass tourniquet to a traumatic amputation.

a. Airway difficulty and carbon monoxide poisoning are the most immediate threats to life. These conditions may have several causes.

(1) Edema of the tissue of the air passages is due to burns from inhaled hot gases. Swelling of the lips and mouth indicates other tissues farther down the airway are probably swollen. This swelling may block the air passages and suffocate the patient. An emergency surgical airway is then indicated. The surgical airway should be made before the air passages are completely closed.

(2) Inhalation of carbon monoxide is a threat even if the patient is not burned. Burning material consumes oxygen and produces carbon monoxide, a poisonous gas. A patient who has inhaled carbon monoxide will exhibit a sensation of suffocation, cherry red flush, and possibly coma. If the patient inhales carbon monoxide, you may need to perform artificial respiration for prolonged periods of time. Also request the evacuation vehicle to bring oxygen and resuscitating equipment to supplement treatment.

(3) Smoke inhalation irritates the air passages and delicate membranes of air sacs in the lungs and can result in a form of pneumonia. When the patient has inhaled such irritation or poisonous material, his lungs must be flushed out with fresh air or oxygen as fast as possible. If the patient is conscious, he can flush the fumes out himself by deep breathing and coughing. If he is unconscious or uncooperative, artificial respiration should be given to force deep breathing. Request the evacuation vehicle to bring resuscitative equipment for use in supplementing treatment. Artificial respiration also will be needed if the patient does not breathe on his own.

b. Shock is another serious threat to life in a burn patient. When extensive areas of skin are burned, the patient cannot properly control loss of body water. If 30 to 40 percent of the body surface receives second or third degree burns, the body will lose 6 to 7 liters of water in 24 hours. If this tissue fluid is not replaced, shock is certain to occur. Since tissues begin to lose fluid as soon as a burn occurs, the sooner fluid replacement is begun, the better. Fluids may be given orally or intravenously. If large areas of the body are covered by second or third degree burns, you should start two or more I.V.'s. Use fluids as directed in paragraph 3–12. Ringer's lactate solution is the best I.V. and may even be given orally if tolerated. To prevent burn shock, start fluid replacement early, both orally and intravenously.

c. Infection is the third cause of burn deaths. It is a late complication, but the organisms causing the infection may enter early after the burn. You should take every reasonable precaution

to prevent this. Apply only dry, sterile dressings over the burn. If you do not have dry, sterile dressings, leave the burn open. Do not cough or sneeze over the burn. Do not pass your hands over the burn any more than is necessary. Do not place a blanket over the burn patient unless the weather is extremely cold. Do not apply medication to a burn. It does little good and when it is removed it will cause the patient much pain. In particular, do not apply greasy substances such as butter, olive oil, or suntan lotion as these will predispose to infection and do no good. The only material presently acceptable for application to the burn surface besides the dry sterile dressing is Sulfamyalon burn cream.

5–11. Chemical Burns

Acids, alkalis, and other strong chemical agents damage the skin, causing chemical burns. A common chemical burn is that caused by white phosphorus, a fast-burning metal used in marking rounds and incendiary grenades. When detonated, the white phosphorus is blown into small pieces. Each particle of phosphorus burns rapidly when exposed to air. Particles striking a soldier will imbed in or stick to his skin and clothing and continue to burn. His clothing may ignite, causing more burns. The only way to stop the phosphorus from burning is to exclude the air (oxygen) from it. Copper sulfate pads are designed to extinguish burning phosphorus. Apply water to the copper sulfate pads and place over the burning phosphorus while wet. If the pad dries out, apply more water; the pad must be kept wet. If you do not have copper sulfate pads, mud is a good substitute. You can wet gauze, but it must be kept wet or it too will ignite, producing more burn. As soon as the phosphorus is extinguished, remove the particles if they are not imbedded too deeply. After removing the particles, cover the burn with a dry, sterile dressing. *Never* use copper sulfate pads as a dressing. If you cannot remove the particles, notify the evacuation vehicle so that additional copper sulfate may be brought for in-transit treatment. For safety of the evacuation vehicle, all patients with white phosphorus burns must be monitored carefully, because a burning piece of phosphorus may ignite the evacuation vehicle. Other chemical burns must be flushed with water to wash away the chemical, then treated as any other burn.

5–12. Evacuation of Burned Patients

To determine category of precedence (para 2–8) for evacuation, you need to know how to classify burns according to their severity. Severity classifications are minor, moderate, and severe. The severity of a burn is determined by the extent of the burn and the degree of the burn. Extent means area. Degree means depth. Burns about the head, face, neck, or chest are severe and the

patient with such burns should be evacuated in the urgent or priority category because of possible airway complications.

a. Minor burns include first degree burns of any extent and second degree burns of small area. Moderate burns include second degree burns of less than 10 to 20 percent of the body surface and small third degree burns. Severe burns are those in which 20 percent or more of the body surface is covered with second or third degree burns. The "rule of nine" is useful for calculating percent of body surface burned. Roughly, these are the portions of body surface over each part of the body: head 9 percent, each arm 9 percent, anterior trunk 18 percent, posterior trunk 18 percent, each leg 18 percent, groin 1 percent.

b. A first degree burn is one where there is a reddening of the skin as in sunburn. A second degree burn is one with blistering of the skin. A third degree burn is one with charring or complete destruction of tissue. At times, in the absence of charring it may be difficult to determine if a third degree burn is present. Some third degree burns have the appearance of leather, or horsehide as on a baseball. As third degree areas have lost their nerve supply, they are insensitive to pain.

c. As a general rule, patients with minor burns should be evacuated in the routine category. Frequently, they need not be evacuated at all. Moderate burns should be evacuated in the priority category. Severe burns should be evacuated in the urgent category.

CHAPTER 6

CHEMICAL, BIOLOGICAL, AND NUCLEAR CASUALTIES

6–1. Problems of the Aidman

Casualties produced by chemical, biological, or nuclear operations could pose many problems for you as aidman. The number of casualties will be large. Material to work with will be in short supply. Evacuation will not be available for many casualties. You will have to be able and ready to advise the local commander on the combat capabilities of his troops. Your determination of men's capabilities will be influenced by the tactical situation.

6–2. Casualty-Producing Chemical Agents

The chemical agents that can be used to injure or to kill men are nerve agents, blister agents, blood agents, and choking agents. You need to be familiar with the characteristics and modes of actions of these agents so that you can prepare for the prevention, tentative diagnosis, and treatment of casualties they produce. Nerve agents and blister agents are the ones you are most likely to encounter.

6–3. Nerve Agents

Nerve agents are lethal (fatal) because they are extremely toxic organic compounds. They can cause death or disability in minutes. They are essentially odorless and colorless. They range in persistency from those which are highly volatile with low persistency, such as standard agent GB, to those with low volatility and high persistency, such as standard agent VX.

a. One of your duties is to indoctrinate the troops in first aid and buddy aid for nerve agent poisoning. The soldier and his buddy must be able to recognize the primary signs and symptoms of nerve agent poisoning. Self-aid and buddy aid can save lives and reduce morbidity. Treatment cannot be started until a man recognizes something is wrong; after recognition, he will probably have to start treatment himself.

b. After local exposure to nerve agent vapor or aerosol, the pupils of the eyes will be pinpointed. If exposure has occurred through the skin or by ingestion, the pupils may be normal or slightly to moderately reduced in the presence of severe systemic

symptoms. Increased production of secretions results in a running nose and excessive salivation. Tightness in the chest results from constriction of the airway with increased secretions in the tracheobronchial tree. Nausea, vomiting, diarrhea, muscular twitching, drooling, and sweating may occur. These symptoms may progress to convulsions, coma, and death. Respiratory failure is the usual cause of death.

c. Immediately after exposure to a nerve agent, the soldier should hold his breath, put on the protective mask, and clear it. Then he should decontaminate his skin and give himself atropine if he has impaired vision, excessive salivation, trouble in breathing, or muscular twitching. He should check his buddy for evidence of exposure to nerve agent, then continue his mission.

d. Act immediately as prescribed in *c* above to protect yourself. Then, check all personnel for symptoms of exposure to nerve agent. If you find casualties, give atropine until symptoms are alleviated; see *e* below.

e. There are several vital steps in the treatment of nerve agent poisoning. The protective mask must be put on as soon as a nerve agent is suspected or signs or symptoms of such poisoning are recognized. Liquid contamination must be removed immediately from the skin or the clothing. (A decontamination kit is provided for this purpose.) Contamination of the eyes is treated by irrigation with copious amounts of water. Atropine must be used on the appearance of any sign or symptom or nerve agent poisoning because it blocks the internal effects of nerve agents. Every soldier should carry three automatic injectors or syrettes of atropine. In freezing weather, they should be carried next to the body to prevent freezing. When used, they should be injected into a muscle. The injection may be repeated every 10 to 15 minutes if symptoms of nerve agent poisoning persist. Under the supervision of a medical officer, as many as 10 to 20 or more doses over several hours may be required to alleviate symptoms in severe exposure to a nerve agent. Such a patient requires urgent evacuation. The patient should not be considered adequately atropinized until he is dry and flushed and has a heart rate of greater than 110 per minute. Since atropine's effect is short-lived, the casualty must be observed for recurrence of symptoms. Atropine is not to be used as a preventive before contemplated exposure to a nerve agent.

f. If there is respiratory embarrassment, the casualty may require artificial respiration even after injection of atropine. Airway obstruction must be relieved by proper positioning of the casualty's head, removal of secretions or vomit from his mouth, and establishment of an airway. If possible, artificial respiration (modified Sylvester or mask-to-mouth) should be given by someone other than the aidman. You should be available to monitor as many persons as possible as long as the threat of nerve agents is present.

6–4. Blister Agents

The blister agents include mustard (HD), nitrogen mustard, lewisite and other arsenicals, mixtures of mustards and arsenicals, and phosgene oxime. This discussion is limited to mustard (HD), a very persistent and standard blister agent, because it is the most widely considered blister agent.

a. Symptoms of exposure to mustard come from its effects on the skin, eyes, mucosal surfaces, and respiratory tract. Exposure of the skin to mustard is followed by a latent period varying with the weather and the degree of exposure. The casualty shows no symptoms for one to several hours after exposure. Then reddening, itching, or burning will occur, followed by blisters. The blisters are second degree chemical burns. Unless the burned area becomes infected, the blisters will heal in from one week to a few weeks. The redness of blister agent exposure should heal in a few days. Some areas of the body heal faster than others. For example, an uncovered area like the face heals faster than a covered area like the buttocks. Prevention of contamination of these burns should receive as much consideration as for thermal burns. Infected mustard burns are treated the same as second degree thermal burns.

b. Severe internal poisoning with mustard may progress to vomiting, diarrhea, and shock. Treatment before symptoms start is nonspecific. Treatment after the onset of symptoms is supportive. The first step in first aid for blister agents is to put on the protective mask for respiratory protection. If the eyes are contaminated, they should be flushed out with copious amounts of water. No other decontaminant should be used on the eyes. The skin should be decontaminated with the decontamination kit the same as for liquid nerve agent. Blisters are treated the same as second degree thermal burns.

6–5. Blood Agents

The blood agents are systemic poisons of the cyanide group. Hydrocyanic acid (AC) and cyanogen chloride (CK) are the main blood agents. They enter the body through the respiratory tract. The central nervous system, especially the respiratory center, is extremely susceptible to their actions. Symptoms of blood agent poisoning include dizziness, headache, trouble with respiration, coma, cessation of breathing, and eventual death. First aid includes putting on the protective mask and giving artificial respira-

tion. Amyl nitrite may be administered by crushing two ampules and inserting them in the face of the mask.

6–6. Agents Used for Special Effects

Chemical agents such as the choking agent phosgene and the tear agents CS and CN may be used for special effects. For instance, phosgene could be disseminated in an area to induce choking among troops. Then a nerve agent could be dispersed among the choking troops to produce casualties. CS and CN may be used in riot control and to force men out of bunkers and foxholes. First aid for these agents consists mainly of putting on the protective mask and wearing it until tests show the agents are not present. If particles of the agents become imbedded in a man's clothing and emit vapors into his face, he should face the wind so that it will carry vapors away from his face. There are no specific medications or treatments for exposure to these agents.

6–7. Mental Incapacitants (Psychochemicals)

Mental incapacitants, or psychochemicals, are chemical agents which disturb normal behavior patterns. They may cause apathy, fear, disorientation, or confusion or so affect mental processes in other ways that the casualty appears psychotic (insane). The management of troops exposed to mental incapacitants will create problems in command and control as well as treatment. You will have no medications to use in treating these casualties. You may be expected to help the commander in managing, controlling, or making the proper disposition of troops which have become casualties. Men wearing the protective mask while a mental incapacitant is being dispersed will not become casualties.

6–8. Biological Operations

Biological operations employ disease-causing organisms to produce human casualties, damage food-producing animals and plants, and cause premature rot of material. Your actions in treating and disposing of casualties with these diseases are the same as for diseases spread by other means. Your biggest problems are in helping the commander in making proper disposition and evacuation of large numbers of casualties. There is little you can do in giving medications for these diseases, but you can do several things to reduce the effectiveness of the operation. You can indoctrinate the troops in the importance of safeguarding food and water and avoiding contaminated food and water. You can instruct them to practice personal cleanliness, control rodents and insects, take prescribed immunizations, and report illnesses and infections promptly. The health of the troops is the commander's responsibility, but he will rely heavily on you for assistance and on the medical service for support.

6–9. Casualties of Nuclear Weapons

a. The aidman's problems in managing or disposing of nuclear casualties are enumerated in paragraph 6–1. In dealing with these problems, compromises must be made. The normal guides for assigning priorities for treatment and evacuation cannot apply in a mass casualty situation.

b. Detonation of a nuclear weapon will produce casualties of three main types: thermal, blast, and nuclear radiation. Thermal casualties will result from the direct effects of the weapon in the form of flash burns. Other burns—secondary or flame burns—will occur in the exposed unit as a result of ignited clothing and material. Flash burns are expected to be first degree, while flame burns will be characteristically second and third degree. Both types of burns must be reevaluated later, but for initial screening and for advising the commander, flash burns are not expected to produce as many serious casualties as flame burns. The number of burned casualties may not be as great as other types of casualties, but they will require more intensive care and put exceptional demands on medical supplies.

c. Blast can be expected to produce more casualties than any other effects of a nuclear weapon detonation. Missiles flying through the air will produce many, varied types of casualties. Glass and other sharp objects will cause lacerations and puncture wounds. Objects such as bricks will cause fractures and contusions. Persons picked up by the blast and hurled against objects may suffer varied wounds. Blast injuries may range from minor wounds to severe wounds with hemorrhage and shock. Your primary duty is first to locate troopers with minor wounds and return them to some kind of duty. The separation of wounded according to type and severity is called "triage and sorting." Initial triage and sorting must be done by you and the commander until more medical personnel arrive. Since you cannot treat all the casualties, you must train as many fellow soldiers as possible in first aid and buddy aid. The better trained men will be valuable in giving emergency medical care if mass casualties occur.

d. Nuclear radiation is of two types. One type comes directly from the fireball. The other type comes from dispersed radioactive particles after the fireball has dissipated. The total amount of radiation received by an individual is more important to you than is the source of radiation. A small total amount of radiation may have little or no immediate effect. A moderate amount of radiation may produce casualties within a day or so. A large amount of radiation may produce casualties immediately. There is no way you can tell when symptoms will appear. A rule of thumb is to

appear. Nausea, vomiting, and general weakness are the main symptoms you will use in the field to evaluate casualties during the initial screening, triage, and sorting. Radition injury has no specific treatment and requires long-term medical management and supportive therapy.

CHAPTER 7

COMMON EMERGENCIES

7–1. Foreign Bodies

Foreign bodies are any external objects which may enter the human body. They include shell fragments, bullets, gravel, splinters of wood, and insects. The foreign object may be in the skin, ears, nose, or eyes. The general rule is, if the object can be easily removed, do so; if it is imbedded and difficult to remove, apply a dressing and evacuate the patient.

a. In the Eyes. Foreign bodies in the eyes are common, especially around helicopter and other aircraft operations. Troops are frequently airlifted into and out of operational areas. Aircraft propellers, especially helicopter rotors, kick up dust, grass, or leaves that get into a soldier's eyes, temporarily incapacitating him. The actions for you to take immediately are:

(1) Place the patient in a sitting or squatting position with his head tilted backward against your body to steady him.

(2) Holding the eyelids open with one hand, pour water from your canteen into his eye(s).

(3) If the objects are flushed out, allow him to continue his mission but check on him later.

(4) If the objects do not flush out, lead the patient to a safe area and make a more thorough examination. If the foreign object will stick to a moistened piece of gauze, remove it. If the object is imbedded, do not try to remove it. Apply a dressing over both eyes and have the patient wait in a safe area until evacuation can be arranged. If objects are imbedded in both eyes, apply a dressing over both eyes and evacuate the patient.

b. In the Ears. Foreign bodies that get into the ears are usually insects. Soldiers resting on the ground often complain of insects crawling into their ears. Using a flashlight, you may be able to attract the insect by directing light into the ear. Another thing you can try is to pour water into the ear; that will bring most insects to the surface. At times, in trying to remove an insect, a patient will poke a finger into his ear and imbed the insect in ear wax so that you cannot remove it.

c. When to Evacuate. You should evacuate all patients with

foreign bodies in the eyes, ears, nose, mouth, or skin which cannot be removed easily. You have too few tools to work with and the consequences can be too serious to do otherwise.

7–2. Accidental Poisoning

Accidental poisoning in the field is not common. Occasionally, a soldier will ingest food or drink that makes him violently ill. Unfriendly people have been known to poison troops. A soldier may eat food which is spoiled, thinking strange and exotic food is supposed to taste that way. He can be sickened also by consuming a bottled soft drink, such as coke, to which the enemy has added poison. This is done by removing the cap from the bottle, adding poison to its contents, recapping the bottle, and selling it to a thirsty soldier. Another method of poisoning is through the selling of poisonous alcoholic beverages. A thirsty soldier may be sold a nonpoisonous drink, or two, of an advertised alcoholic beverage, then offered a bottle of what is supposed to be the same or a better beverage. While under the influence of the first one or more "good drinks," he consumes the "better beverage." It can contain one of many poisons, the commonest being methyl or wood alcohol. When an individual complains of stomach pain, nausea, vomiting, or diarrhea after eating or drinking some questionable substance, you should suspect poisoning. First aid is as follows:

a. Dilute and flush out. Encourage the patient to drink plenty of water. Filling his stomach with water dilutes the poison. Instruct him to stick his finger behind his tongue to trigger the gag reflex. If he is unable to do this, you can do it for him to induce vomiting. This process may be repeated once or twice, depending on how much foreign material is flushed out of the stomach. Contents of the stomach come out as a clear liquid when it is clean of foreign material.

b. Get powdered milk if available from C rations and make a canteenful of milk. Have the patient drink as much milk as he can tolerate.

c. Evacuate the patient for further evaluation.

d. Use these same procedures when a patient has swallowed an overdose of medication or drug, but do not flush or cause vomiting if he has swallowed a corrosive agent (acid or alkali).

7–3. Poisonous Plants

Poisonous plants are found in many countries, but are most abundant in areas with heavy foliage. Dense vegetation has plants to which many persons are allergic, such as poison ivy, poison oak, and poison sumac. Skin eruptions and itching may occur hours after exposure. By then the patient may not know which of many plants caused the condition. You can only treat what you find and caution other troopers to cover their bodies as much as possible. (For specific conditions and treatments, see para 11–9.)

7–4. Snake Bites

Snake bites are unusual, even in snake-infested areas. Generally, a snake will avoid a man unless it is forced to defend itself. If you encounter a snake at close range, do not make any sudden moves. Back away slowly. A snake can strike accurately for a distance equal to about one-half of its length. Both poisonous and nonpoisonous snakes will bite if provoked.

a. Symptoms of poisonous snake bites include the following:

(1) Pain at the site of the bite. In some cases, pain is immediate and severe. In others, pain may be delayed and slight.

(2) Immediate swelling and discoloration.

(3) Early signs and symptoms of shock.

(4) Headache, dizziness, and blurred vision.

(5) Impairment of circulation, respiration, and coordination.

b. If bite is on an extremity, place an improvised venous tourniquet or constricting band above the bite and above the swelling. As swelling advances up the extremity, move the tourniquet above it.

c. Immobilize the bitten area as much as possible. Movement speeds circulation within the area.

d. If a medical treatment facility is less than one-half hour away, do not make incisions. If immediate evacuation is not available, proceed to make incisions parallel to the veins over the fang marks about ½ inch long and ½ inch deep. The incisions should *not* cross. Oral or mechanical suction will help in getting drainage. Remember though, that oral suction by an individual with cuts or sores in the mouth endangers him to poisoning. Be sure to cover the wound with a sterile dressing to avoid a secondary infection.

e. If signs and symptoms of shock develop, start an intravenous infusion of any available solution, preferably Ringer's lactate solution or saline.

f. If there are no serious signs or symptoms, treat the symptoms which are present. Hold the patient for observation and routine evacuation.

7–5. Insect Bites

Insect bites are frequent in the field. They may be merely a nuisance or they may be serious. In persons who are extremely allergic to certain insect bites, severe reaction may follow the bites. If a severe reaction occurs, an oral dose or an injection of Benadryl may help to minimize the symptoms. If the reaction is so severe that respiratory difficulty and unconsciousness develop,

epinephrine must be injected (para 7–6b(3)). Artificial respiration may be needed. Urgent evacuation is essential. Itching of a less severe insect bite can be relieved by rubbing tetracaine or another local anesthetic ointment on the skin. Tetracaine ointment could be a useful item for you to carry for men in stake-outs, listening posts, or other places where noisy scratching or slapping at insects would reveal their position to the enemy. However, the use of local anesthetic ointments should not be substituted for the proper use of insect repellents.

7–6. Allergic and Anaphylactic Reactions

Some individuals are highly sensitive to certain substances when eaten, breathed, or injected into the body. These individuals have an allergic reaction of variable degree when they take in a substance to which they are allergic. These reactions, affecting the entire body, may occur anywhere.

a. Urticaria. The common term for urticaria is "hives." This type of less severe systemic allergic reaction involves primarily the skin. Raised areas that itch appear in the skin all over the body. In some areas these are large and even connected to each other, causing generalized swelling of those areas. This is called "angioneurotic edema" and occurs usually in the face. Although the patient with urticaria is uncomfortable, the problem is not usually life-threatening unless anaphylaxis develops (para 11–13a). Angioneurotic edema may involve the tongue and, in that way, it could produce suffocation.

(1) Determination of the substance which provoked the urticaria may be difficult or impossible. If it is identifiable, the individual should avoid it in the future.

(2) Treatment involves administration of an antihistamine such as Benadryl. In more severe urticaria, 50 mg. of Benadryl should be given intramuscularly (I.M.). The reaction may take from hours to one or two days to subside, and evacuation may be necessary.

(3) It is critically important to observe patients with urticaria for development of anaphylaxis, which is often fatal.

b. Anaphylactic Reaction. This is the most severe allergic reaction. It produces intense bronchial edema. Breathing may be difficult or impossible. In addition, the circulatory system breaks down due to dilation of the arteries and leaking of the capillaries. Blood pressure falls. Death may result if proper treatment is not given immediately. Antibiotics are the group of drugs which most commonly produce anaphylactic reaction. Yet these reactions can result from drugs as common as aspirin, food allergies, and insect bites. Any time you are to administer a drug to a patient, especially by injection, you should first question him as to allergy and then observe him at least 15 minutes for possible development of anaphylaxis.

(1) Although urticaria is usually present, the findings to look for are breathing difficulty (wheezing) and circulatory collapse (pulse, blood pressure, state of consciousness). The wheezing may be the limit of the reaction, but the patient must be observed closely until the wheezing disappears. If it worsens, if the patient is having great difficulty in breathing, if he becomes stuporous or comatose, or if his blood pressure drops (weak, thready pulse), immediate therapeutic steps must be taken.

(2) Apply a tourniquet above the injection site or the insect bite. This will help slow or prevent further allergen from getting into the circulation.

(3) Keep the patient breathing by maintaining an airway and using positive pressure artificial respiration if necessary. An emergency surgical airway probably is not indicated because the obstruction involves the smaller bronchi. Epinephrine should relieve the obstruction. An artificial oral airway may be helpful if the tongue is swollen.

(4) Start an I.V., using saline-type infusion to help maintain blood pressure and to provide a rapid route for infusion of drugs. Be prepared to start closed chest cardiac massage if cardiac arrest occurs.

(5) Urgent evacuation must be obtained, and the patient should be accompanied by someone trained in artificial respiration.

CHAPTER 8

SEASONAL HAZARDS—HOT AND COLD INJURIES

8–1. Heat Injuries

Heat injuries are grouped as heat cramps, heat exhaustion, and heat stroke.

8–2. Heat Cramps

Heat cramps are due primarily to loss of salt from the body. Excessive sweating without replenishing salt will deplete body salts. A soldier with heat cramps complains of painful cramps in muscles of his legs and abdomen. Determine the amount of water intake and the amount of sweating. If his water intake is low and sweating is excessive, you can assume he has heat cramps. If you diagnose heat cramps, dissolve two crushed salt tablets in one canteen of water. Let the patient drink as much of this solution as he wants. In 15 to 30 minutes, he should be well if heat cramps are the problem.

8–3. Heat Exhaustion

Heat exhaustion is more serious than heat cramps. Caused by an excessive loss of water and salts from the body, heat exhaustion is a condition, preceding circulatory failure, in which there is not enough fluid to fill the vascular system and tissue spaces. The patient complains of dizziness, headache, weakness, nausea, vomiting, and cramping in muscles of his legs and abdomen. He usually has hot, moist, and pale skin. If not treated rapidly, heat exhaustion may lead to shock (circulatory failure). Once you have recognized heat exhaustion, treat it as follows.

a. Give fluids orally with salt, but do not induce vomiting.

b. In severe case of heat exhaustion, if the patient is nauseated or vomiting, start intravenous infusions of Ringer's lactate solution or saline if available as soon as possible.

c. If vomiting and nausea are present, you may give compazine as directed by a medical officer. (You must have the permission and advice of your medical commander to carry compazine and to dispense it.)

d. If the patient is not stabilized, he should be evacuated as a

priority. If stabilized, he may be evacuated as a routine or given light duty.

e. The best treatment is prevention. As soon as you see a soldier staggering, weak, or sweating excessively, ask him about his intake of water and output of urine. Lack of urine output is a danger signal. You must either notify the immediate commander (so that a rest period can be arranged) or plan on evacuating the patient. Give oral fluids and salt as the patient can tolerate them. (When operating in a hot environment, you should carry salt tablets and an extra canteen of water.)

8–4. Heat Stroke

Heat stroke is a malfunction of the body's heat regulating center in the brain. It is entirely different from heat cramps or heat exhaustion. Because of the patient's exposure to high temperatures, especially if he has been without a head cover, his central nervous system becomes incapable of controlling body temperature. The rectal temperature will be elevated to 106° F. or higher. Other signs and symptoms include headache, dizziness, loss of consciousness, and dry, hot skin. The patient may die quickly unless you take positive measures immediately. His body must be cooled rapidly. You can do this by immersing him in a stream or a canal or by pouring water over him and fanning him. The object of treatment is to reduce the body's temperature to about 101° F. as quickly as possible. The ideal method is to immerse the patient in an ice bath. Since you cannot do that in the field, you should duplicate it as closely as you can. All heat stroke patients should be evacuated as "urgents."

8–5. Cold Injuries

The serious cold injuries include trench foot and frostbite. Prolonged exposure to extreme cold produces severe injuries. Patients with relatively minor injuries must be reevaluated if prolonged environmental exposure to cold is a problem. Patients designated for routine evacuation should be given a higher category after prolonged exposure.

8–6. Trench Foot

Trench foot is caused by prolonged exposure to cold and wetness and by diminished circulation. Trench foot is worsened by keeping the feet still, or by wearing tight-fitting boots. Symptoms include uncomfortable numbness of the feet, clumsiness in walking, tingling and aching, cramping pain, and swelling of the feet. The treatment is to warm the affected parts in warm water or next to a warm body. Remove wet or constricting socks and boots. Do not massage or rub the affected parts; massaging frozen parts breaks down tissue and aggravates the injury. Cover blisters and frozen areas with a dry sterile dressing applied loosely. Trench foot is prevented by maintaining circulation in the feet. This is done by avoiding prolonged inactivity of the feet and wearing loose-fitting dry socks and boots. If a soldier must stand in one place a long time, force him to exercise his feet to stimulate circulation.

8–7. Frostbite

Frostbite is the freezing of tissue in a localized area. It is caused by a lack of circulation of blood in the frozen area. Constriction of vessels by extreme cold prevents circulation of blood in the involved area. The result is tissue anoxia and death of the tissue. Symptoms of frostbite include an uncomfortable coldness in the affected area, followed by numbness. The skin at first is red, then pale or waxy white. The injured part has no feeling while it is frozen. In severe frostbite, edema and hemorrhage may occur when the part is thawed. First, you should remove all wet or tight clothing from the frostbitten area. Warm the area. The best method of warming is to place the involved area in a water bath at 104° F. If this is not available, the involved area can be warmed by placing it against the skin of some other area of his body or someone else's body. The patient should not be allowed to smoke, because nicotine in tobacco may further constrict blood vessels. Cover the frostbitten area with a loose, dry dressing. Do not try to force circulation to return to the frostbitten part by rubbing it. Treat the man as a litter patient if his feet are involved. To minimize cold weather injuries, rotation of troops is advisable during periods of exposure. They should practice the buddy system of inspecting one another for early detection of frostbite. Troops exposed to extreme cold for a very long time become numb and drowsy, with slowing of reaction time and impaired vision. You should remain alert to these possibilities and be ready to advise the commander on the proper use or the evacuation of patients with cold injuries.

8–8. Immersion

Prolonged immersion of a part of the body in water for hours, even in semitropical and tropical areas, can cause immersion injury (para 11–11). A form of immersion foot also results from immersion of the feet in cool or cold water. The colder the water is, the more rapidly injury occurs. The treatment is to rewarm the patient's feet to normal temperature. Then, if the tissues have been damaged, as in frostbite, the treatment would be similar to that for frostbite.

CHAPTER 9

DRUG ABUSE AND EMOTIONAL PROBLEMS

Section I. DRUG ABUSE

9–1. General

The term "drug abuse" means illicit use of drugs, whether legal or not, to obtain certain nontherapeutic effects. In other words, the drug abuser takes the drug for reasons other than diagnosis, treatment, or prevention of disease. This section discusses briefly medical problems related to drug abuse.

9–2. Categories of Commonly Abused Drugs

Three categories of drugs are commonly abused. Their classification is based upon the effect of the drug on the central nervous system.

a. Depressants. Intemperate use of alcohol is the most common abuse of drugs in this category. Barbiturates and narcotics (such as heroin) also are primarily depressants. These drugs generally give the user a relaxed, tranquil sensation. Used in excess they can produce lethargy, coma, and even death. All are addicting.

b. Stimulants. These are primarily the amphetamine-type drugs. Their usage generally results in increased alertness and euphoria. Excessive use may produce psychotic reactions and death from high blood pressure. These drugs are addicting and they frequently lead to death if excessive use is continued over a period of months.

c. Hallucinogens. These drugs are difficult to classify either chemically or as to effect on the user. Marijuana, which can also be classed as a mild depressant, is the most commonly used hallucinogen, and its effects are generally the least noticeable. Other hallucinogens are LSD, STP, peyote, and mescaline. These drugs tend to produce various degrees of hallucination in the user. The result is a transient psychosis of "trip." Occasionally, the psychosis persists. Generally, these drugs are not known to be directly toxic except so far as the user may be led to behave in a hazardous manner.

9–3. Diagnosis and Treatment of Acute Drug Intoxication

Intoxication depends upon the type and amount of drug used.

a. Depressants. These drugs generally produce lethargy in the user. He may be sleepy, unresponsive, uncoordinated, breathing slowly, and slurring his speech. The narcotics (such as heroin, morphine, cocaine, meperidine, and codeine) often produce constricted or "pinpoint" pupils; alcohol and barbiturates have no effect on the pupils. Alcohol produces a characteristic odor on the breath. Recent needle marks on the body suggest drug injection. Treatment of acute intoxication with depressants is primarily supportive. The usual cause of death among users is respiratory failure. Consequently, you may need to perform artificial respiration (para 3–9) until the patient can breathe on his own. Even if he is breathing when you first see him, be sure he is kept under observation in case the effects of the drug deepen. Induction of vomiting may be helpful if the drug was taken orally in the immediate past. Administration of a stimulant such as coffee may be useful; but more powerful stimulants should be given only by a medical officer.

b. Stimulants. Physical evidence of amphetamine intoxication includes hyperactivity, manic or psychotic behavior, agitation, rapid speech, rapid heart rate, high or low blood pressure, dilated pupils, confusion, restlessness, panic states, and convulsions and coma. Treatment is largely symptomatic and may include induction of vomiting and sedation. However, you should not sedate the patient. Rather, evacuate him as soon as possible.

c. Hallucinogens. As with the other types of drugs it is difficult to list diagnostic physical findings which will tell you the patient is under the influence of a hallucinogen. The physical findings, in fact, may be virtually nothing. Your only clue may be the mental state of the patient. Both depressed and stimulant types of behavior may result. In other words, the patient may be depressed and unresponsive or panicky and hyperactive. He may be completely out of touch with reality. Your best help may come from the patient's story or from the history given by his friends. Treatment is generally supportive, although with severe reactions certain tranquilizers (such as chlorpromazine) may be used. This treatment should be performed by a medical officer.

9–4. Chronic Drug Abuse

It is not the purpose of this manual to philosophize or to moralize about drug abuse. Aside from providing emergency care for the acutely intoxicated drug abuser, there is little you can do to curb chronic drug abuse. Perhaps the most important responsibility you have is to educate the troops about the dangers of drug abuse, especially in combat situations. You should also be able to advise the commander about the capabilities and limitations of drug users in the field. The Army is developing extensive programs for rehabilitation of chronic drug abusers. Your responsibility is to refer men who come to you for help to the appropriate facility.

Section II. COMBAT EXHAUSTION

9–5. Definition

Combat exhaustion is a transient emotional reaction or disturbance resulting from the psychological and physical stress of battle which is severe enough to make a soldier ineffective in combat. The term "combat exhaustion" is used because it suggests a temporary condition, originating in combat, that may be overcome rapidly. Combat exhaustion differs from normal battle reactions. Normal reactions may appear as increased muscular tension, shaking or tremor, sweating, loss of appetite, and rapid heart beat. Combat exhaustion is a harmful extension of these signs and symptoms. As fatigue, hunger, and fear of battle continue, worry and uneasiness increase. When a soldier cannot cope with these feelings, he develops combat exhaustion.

9–6. Factors Influencing Combat Exhaustion

Various stresses in combat contribute to combat exhaustion. One is the constant presence of danger. Another is frustration and boredom caused by long periods of waiting. Loss of sleep is a factor. So is the rarity of hot meals. Sore feet, minor wounds, and skin diseases also contribute to combat exhaustion. Inadequate orientation of newly arrived troops is another factor. Soldiers may also be upset by propaganda or bad news from home. They may consider the systems of reward and punishment unfair, or be disillusioned with the cause for which they are fighting.

9–7. Signs and Symptoms of Combat Exhaustion

a. Increased pulse rate.
b. Increased muscular tension.
c. Stomach cramps, vomiting, and diarrhea.
d. Abnormal respiration.
e. Heightened reaction to noise.
f. Increased alertness causing sleeplessness.
g. Anticipation of disaster.
h. Hypochondriasis (feigned illness).
i. Extreme changes in mood, ranging from crying and complete breakdown to apathy or complete indifference.

9–8. Prevention of Combat Exhaustion

It takes the combined efforts of the commander, yourself, and your fellow troopers to prevent combat exhaustion. You have the most important part in this. If you are alert, you can detect early

signs of combat exhaustion. That is wheu you can do the most good for the potential patient. When a soldier complains of vague symptoms, looks nervous, and makes rash statements, you should become suspicious. If these symptoms get worse, you should talk privately with the soldier's platoon sergeant or immediate supervisor. This working relationship between you and the leaders can prevent most cases of combat exhaustion. Leaders should know about the disturbed individual so that he is not assigned to a sensitive task.

9–9. Disposition of Patients

Patients with combat exhaustion should be treated early while they are in their platoon or element. You should enlist the aid of the patient's leaders and buddies in initial treatment. The following are some of the things you can do.

a. Give additional consideration to the patient's wounds or infectious. Change the dressings and apply medications. Emphasize reassurance. Show interest in the man and see that he gets rest.

b. Request his immediate commander to give him some words of praise and assurance. Assure the patient that he is needed and appreciated.

c. Do not permit anyone to scold or ridicule the patient. Slapping or otherwise abusing a patient to "bring him out of it" is wrong. The patient would not behave in this manner if he could help himself.

d. Request one of the commanders to reorient the patient as to the mission and his importance to it.

e. If the patient has problems at home, reassure him that you will go with him later to the proper authorities to try to resolve them. Then, do it.

f. Encourage some of his buddies to talk to him and promise to cover him if they are attacked.

g. Do not evacuate the patient unless it is entirely necessary. If it is to the advantage of the patient and the element to evacuate him, do so by resupply vehicle rather than medical evacuation. The patient should not get the impression that he has a serious mental illness or is mentally incapacitated. Irreversible damage can be done to a patient if he is labeled a "psycho." Unless the patient has a complete breakdown, evacuate him to company headquarters for rest and assistance. Evacuate him to a medical facility only when that is entirely necessary.

CHAPTER 10
NONTRAUMATIC DISEASE

10–1. Introduction

Traumatic injuries, such as those produced by bullets and grenade fragments, are relatively easy to diagnose. The problem is usually easy to see. Diseases caused by bacteria or other infectious organisms are much harder to diagnose. Following certain procedures, however, will aid you greatly in discovering and treating the problem. This chapter outlines general principles in approaching nontraumatic, or medical diseases. The remaining chapters in this manual deal with specific medical diseases of each system of organs.

10–2. Examination

a. You can find out much about a patient by using your sight and touch and by asking questions. The appearance of a soldier when you first see him tells much about his condition. You can see if he has trouble breathing. You can see if the color of his lips, face, or fingernails is abnormal. Looking at him, you can tell if he is having a chill. A rash on his skin will be evident to you, too. Touching his skin, you can tell if it is wet or dry, cool or hot. You can ask him what his complaint is, and whether he has had it before. Does he have a headache? Diarrhea? Pains? What kind of medicine has he taken lately?

b. The examination you make differs from the medical officer's mainly in degree of sophistication. Your equipment and assistance are limited. The medical officer in the hospital can request X-rays and laboratory tests of the patient to aid his examination. After making the diagnosis, the medical officer either treats the patient or evacuates him—which are the same actions you take in the field.

10–3. Routine Tests

Sometimes, you need to tell a patient exactly what laboratory test or other diagnostic procedure may be done on him. For instance, to a patient with a fragment wound, you might explain that X-rays will probably be ordered by a physician to determine whether or not a fragment is imbedded in his leg or arm. A simple explanation

of tests and examinations such as the following may help to relieve a patient's apprehension.

a. Blood is taken for cell counts, studies of blood chemistry, crossmatching before transfusions, studies for malaria parasites, and other tests.

b. Urine is collected to detect acidity or alkalinity and the presence of blood cells, sugar, protein, and certain minerals.

c. Samples of feces are studied for evidence of blood, bacteria, amoeba, worms, mucus, and pus.

10–4. Instruments for Examinations

There are many special instruments to aid medical personnel in examining patients. However, you will have few or none of these when you go into the field. You do not need them. A rapid, thorough examination using your own senses is all you need to arrive at the key decision you must make—whether or not to evacuate the patient. Instruments used by medical personnel in the rear, such as thermometers, stethoscopes, otoscopes, ophthalmoscopes, and sphygmomanometers, often do little except put numbers on a medic's findings.

10–5. Principles of Treatment

In treating a patient, you try to do three things: arrest, stabilize, and return to normal.

a. Arrest means to remove the cause from the patient or remove the patient from the cause. If a soldier's clothing is burning, either put out the fire or tear off the burning clothing. If a soldier is in a toxic chemical environment, either remove him from the environment or put the protective mask on him. If a soldier is suffering from heat stroke or heat exhaustion, remove him from the heat and begin to stabilize him. If a soldier has an acute disease with high fever, reduce the fever and continue the treatment.

b. Stabilize means to get the patient into the best possible condition for evacuation or treatment. This could mean doing any of a variety of things. It may mean reducing a high fever, starting intravenous medication, giving oxygen, getting the patient into a better environment, or putting him in a comfortable position.

c. Return to normal is the ultimate goal of medical treatment. This is done by removing the cause of the abnormal condition and helping the body to repair damaged cells, tissues, and organs.

10–6. Fever

Most complaints which bring patients to you will be localized; that is, they will indicate a problem in some specific area of the body. Back pain, headache, cough, pain on urination, and diarrhea are examples of localized complaints. However, one very important symptom or sign is fever, which is not localizing. Knowledge of the presence of fever is useful to you, because it establishes firmly the presence of disease. It may be the only way you can determine that a patient with vague complaints is really sick.

a. Be sure that fever really exists. Do not take the patient's temperature immediately after he drinks a hot or cold liquid. If he claims to develop fever only at night, invite him to visit you when he has the fever.

b. Fever indicates inflammation (usually infection) somewhere in the body. The most dangerous possibility is meningitis (para 17–8*a*); you should always check the patient with fever for a stiff neck. Careful questioning about the major body systems will often reveal the general area of the inflammation (respiratory, gastrointestinal, or genitourinary).

c. Fever itself can be dangerous if it is excessively high (105° F. or higher). In this case you must reduce the body temperature as rapidly as possible. Administer oral aspirin (two tablets) and give the patient alcohol baths, ice water baths, or anything which might cool him. Encourage him to drink fluids since fever also tends to dehydrate the body. Intravenous fluids may be necessary in very sick patients.

d. Lower temperature fevers may be treated with two aspirin tablets every 4 hours. First establish and record the presence of fever in the patient. If he is to be evacuated, note clearly on the records that aspirin has been given and when it was given.

e. Patients with fever must not perform duties. They must rest. Refer them to a medical officer. If the temperature is 105° F. or higher, request urgent evacuation.

10–7. Immunization

Many diseases are easy to prevent but hard to treat. Tetanus and rabies can be prevented by immunization, but once their symptoms appear they are usually fatal. Cholera can usually be prevented with proper immunization. Immunizations prescribed by the Army are effective in preventing many diseases. Every soldier is responsible for receiving all immunizations for his assigned area which are available to him and keeping them current. It is your responsibility to advise the soldier and help him in getting the required immunizations. The immunizations normally given to military personnel are for smallpox, cholera, yellow fever, tetanus, typhoid, poliomyelitis, influenza, diphtheria, and plague.

CHAPTER 11
DISEASES OF THE SKIN

11–1. The Skin

The skin is a tough, elastic structure covering the entire body. It has two principal layers, the epidermis or outer layer, and the dermis or inner layer. The epidermis has a superficial layer and inner layer. The superficial or horny layer consists of dead cells which are constantly being worn off. These are replaced from the living cells which form the inner layer. The dermis is the thicker part of the skin. It consists of connective tissue containing blood vessels, nerve endings, sweat glands, sebaceous glands, and hair follicles.

11–2. Functions of the Skin

The skin is the largest organ of the body. It performs the following functions:

a. Protection. The skin protects underlying structures by acting as a mechanical barrier. When the skin is broken, microorganisms may invade the body through the opening.

b. Regulation of Body Temperature. The skin regulates body temperature by controlling heat loss in two ways.

(1) Blood vessels in the skin change in size. They dilate and bring warm blood to the surface to increase heat loss. They constrict to decrease heat loss.

(2) The skin produces sweat which, when it evaporates, cools the surface of the body.

c. Sensory Perception. The skin acts as an organ of perception. It contains sensory nerve endings specialized to detect heat, cold, pressure, touch, and pain.

d. Secretion. Sweat is salt water which cools the body by evaporation on the skin. It is secreted by the sweat glands which open by ducts onto the surface of the skin. The ducts or openings are called pores. Sweat glands are distributed in large numbers over the body. They secrete an average of 1 quart of sweat a day. The amount of sweat varies considerably, depending upon the atmospheric temperature and humidity and the amount of exercise performed by the individual. Sweating is continuous, but it may be

so slow and the sweat may evaporate so quickly that it is imperceptible. Sweat consists chiefly of water (99 percent), with small quantities of salts and organic waste products. The skin also secretes a thick, oily substance called sebum, which is produced by the sebaceous glands. Sebum lubricates the skin and keeps it soft and pliable.

e. Absorption. Although absorption is not one of its normal functions, the skin can absorb water and other substances. Some drugs may be taken into the body by absorption. Certain nerve agents, for example, are absorbed rapidly through the skin.

11–3. Terms Used for Abnormal Skin Conditions

a. Bulla. Large blisters filled with serous fluid.

b. Cellulitis. Infection involving all layers of the skin and inflammation of the loose cellular tissue that lies under the skin.

c. Dermatitis. Inflammation of the skin.

d. Edema. Excessive collection of watery fluid in tissue.

e. Erythema. Redness of the skin.

f. Folliculitis. Infection of hair follicle(s).

g. Furuncle. A boil.

h. Impetigo. Bacterial infection limited to the epidermis.

i. Induration. Hardness.

j. Lesion. Any localized abnormality.

k. Pustule. Vesicle containing pus.

l. Pruritis. Itching.

m. Rash. A temporary eruption on the skin.

n. Ulceration. Open sores on the skin.

o. Vesicle. Small blister.

11–4. Elements Hostile to the Skin

Since the skin is large and constantly exposed to man's environment, it is certain to be one of your biggest medical problems. Weather, insects, disease germs, and trauma are some of the hostile environmental elements which frequently attack the skin. This chapter discusses primarily infections and allergies of the skin. Heat and cold injuries are covered in chapter 8, trauma and burns in chapters 4 and 5.

11–5. Viral Infections of the Skin

a. Verruca Vulgaris. This is the common wart. There is no effective medication for the removal of warts. They can be removed by cautery, freezing, or surgery. No way is known to prevent warts.

b. Herpes Simplex. This infection is called a fever blister or cold sore. It usually occurs on the lips, but it may appear on other parts of the body. It occurs as a small, painful vesicle (blister), either singular or in clusters. No medication cures or dries up herpes simplex. Treatment is symptomatic (directed toward relieving the discomfort). No way is known to prevent herpes simplex, but the patient can keep it from spreading if he does not scratch it. Never put cortisone-type cream or ointment on these lesions.

c. Herpes Zoster. This is the painful viral infection commonly known as "shingles." It appears as a large group of vesicles along a sensory nerve path. The lesions are very painful. They usually appear on the skin of the abdomen from under the ribs toward the navel. The area of the skin along the path of the vesicles is red and tender to the touch. There is no specific medication for shingles and no method of preventing it. Treatment is directed to relieving pain and discomfort. Never apply cortisone-type cream or ointment to these lesions, for that will only make them worse.

11–6. Bacterial Infections of the Skin

a. Bacteria are single cell forms of life, visible only under a microscope. Most are harmless to man. Some are even necessary to life, like those in the intestines which make vitamins K and B12. Bacteria are always on the skin. It is not possible by any safe method to kill all of them. Many bacteria live on the surface of the epidermis, and most are harmless. The largest numbers of bacteria live in the hairy openings of the skin. Washing with soap and water removes some bacteria. This may be worthwhile if it is not done so often or so roughly that it damages the skin barrier. Pure alcohol kills some bacteria. Most effective is a mixture of 70 percent alcohol and 30 percent water, which is used to sterilize the skin before injections. Iodine solutions are also used to kill bacteria, but care must be taken to avoid iodine burns of the skin. Burns may be prevented by wiping off excess iodine with 70 percent alcohol.

b. Bacteria on the skin need moisture to grow and multiply. In hot, humid weather, bacterial skin infections are common because skin bacteria multiply greatly under hot, moist conditions. The moisture of a cut or scratch also helps the growth of bacteria.

c. The bacteria that cause the most skin infections are staphylococcus aureus, commonly called "staph," and Beta hemolytic streptococcus, commonly called "strep."

11–7. Types of Bacterial Infections of the Skin

a. Impetigo. Impetigo is a bacterial infection limited to the epidermis. It is caused by staph or strep, but often by a combination of both. It begins suddenly, usually on the face, arms, or legs. One or a dozen lesions may be present. Bacteria can lodge on clothing or under fingernails and be spread to other parts of the

body or to other persons. Impetigo is mildly tender to the touch, and it itches or burns slightly. The skin surrounding the lesions appears normal at first, but a ring of redness develops in a day or two. Impetigo may develop in a few hours as a vesicle, a pustule, a bulla up to 3 inches in size, a raw glistening spot, or a crack in the skin. Within a day or so, a soft, soggy, yellow or colorless crust forms that is fairly easy to remove. An infected fever blister, infected hangnail, infected insect bite, cut, or burn at the same site or elsewhere on the body may be the source of bacterial infection. Often there is no preceding skin infection. Since it is superficial, impetigo heals without scarring, but it may leave a red or brown mark which disappears in 2 weeks.

b. Ecthyma. Ecthyma is similar to impetigo except that it goes into the dermis and heals with a scar. Ecthyma has a tough, hard, brown or black crust that is difficult to remove. When the crust is removed, the raw base may bleed. This crust can form again in a few hours. Squeezing or pressing on an ecthyma causes great pain. The raw base leaves an ulcer which is very painful to the touch. Ecthyma may be either a staphylococcic or streptococcic infection.

c. Folliculitis. Folliculitis is an infection of a hair follicle. It is small and slightly tender and contains pus. Although usually due to bacteria, it can be caused by fungi or chemical.

d. Furuncle. Furuncle, or boil, is a staphylococcic infection of a hair follicle and tissue around it. There is redness and pain. At first, there may be only a red lump, but in a few days a yellow "head" develops on the surface. When a furuncle opens, pus, blood and a plug of dead tissue (core) comes out. If the furuncle is small, it heals without a visible scar.

e. Cellulitis. Cellulitis is a diffuse staphylococcic or streptococcic infection of cellular or connective tissue spreading widely through all layers of the skin. It can be a complication of a localized infection, such as a furuncle, or it can occur alone.

f. Lymphangitis. Lymphangitis is an infection with red streaks in the skin going up the lymph vessels of the leg or the arm from ecthyma, cellulitis, or any infected skin lesion. Lymphangitis generally is caused by a streptococcic infection. Chills and fever often occur with it. Regional lymph nodes in the armpit or the groin draining the affected extremity may be swollen and tender.

11–8. Treatment of Bacterial Infections of the Skin

a. The most important procedure in the treatment of localized skin infections is to keep them clean. Gentle washing or soaking in warm water containing surgical soap several times a day is generally ideal. In impetigo and ecthyma the crust must come off. Soaking in warm water should loosen the crust for removal. Pus accumulates under the crust and infection spreads under it. The crust keeps the edges of the skin from growing together and healing. Usually there is bleeding when the crust of ecthyma is removed no matter how gently it is removed. For noncrusting localized skin infections, such as furuncles or folliculitis, cleansing and warm water soaks are effective. Do not squeeze a furuncle. Squeezing may cause cellulitis to develop. Antibiotic skin creams may be valuable in treating skin infections.

b. Systemic antibiotics are required treatment for nonlocalized skin infections and multiple localized infections. Examples of such infections are more than three lesions of impetigo, more than two ecthymas, and any lymphangitis, cellulitis, or folliculitis if it is sore and painful and several lesions are present. Refer these patients to a medical officer as soon as possible; you should never prescribe systemic antibiotics.

11–9. Fungal Infections of the Skin

a. Fungal infections of the skin are common. Fungi are tiny multicellular plants without roots, stems, leaves, or green pigment (chlorophyll). They feed on dead or living organic matter. Examples of fungi are mushrooms, bread molds, and leather mildew. Although many thousands of fungal species exist, only 20 species of fungi can live on the human skin and produce disease.

b. Fungi that attack the human skin use the dead outside layer for food. As they grow, they digest the dead layer and cause the skin to redden, blister, scale, and itch. They may grow out from the center to get more food, sometimes causing ring-shaped lesions commonly called "ringworm." Patches of blisters and dull, red scales between the toes, soles of the feet, and on top of the feet, ankles, groin, face, and scalp are usually caused by one class of fungi. Yeast (another class of fungi) infects the groin, armpits, anus, buttocks, and any moist, warm area where skin rubs against skin.

c. Fungal infections usually begin as small, red, scaling macules around the feet, ankles, groin, or buttocks. In a few days, they become papular, usually scaling on the advancing edge, and tiny vesicles appear. Mild at first, itching becomes worse as inflammation increases, often waking the patient. Itching of the groin is particularly severe at night. The center of the lesion is less red than the edges, producing the ringworm. The papules enlarge and grow together, forming large areas of dermatitis. The entire buttocks and legs may be involved. When the onset is acute and very rapid, groups of tiny vesicles or pustules are seen. The itching is usually severe. The patient scratches off the tops of the pustules. Then bacteria invade and cause a secondary infection. Crusts and cellulitis may result. On hairy areas, fungus may grow into the hair follicles, causing pustules, small boils, or folliculitis.

11–10. Treatment of Fungal Infections

Antifungal cream (fig 11–1) is used to treat all fungal infections because it is antifungal, antipruritic, anti-inflammatory, and antibacterial. If this cream is not available or the patient cannot tolerate it, you may use 1 percent tolnaftate (Tinactic) solution. Rub the cream gently into the infected areas until it disappears. If you can see the cream after rubbing, you are using too much. It is especially important to rub it in well in the groin and between the toes. After the infection has healed the cream should be used at least 1 week to prevent the infection from recurring.

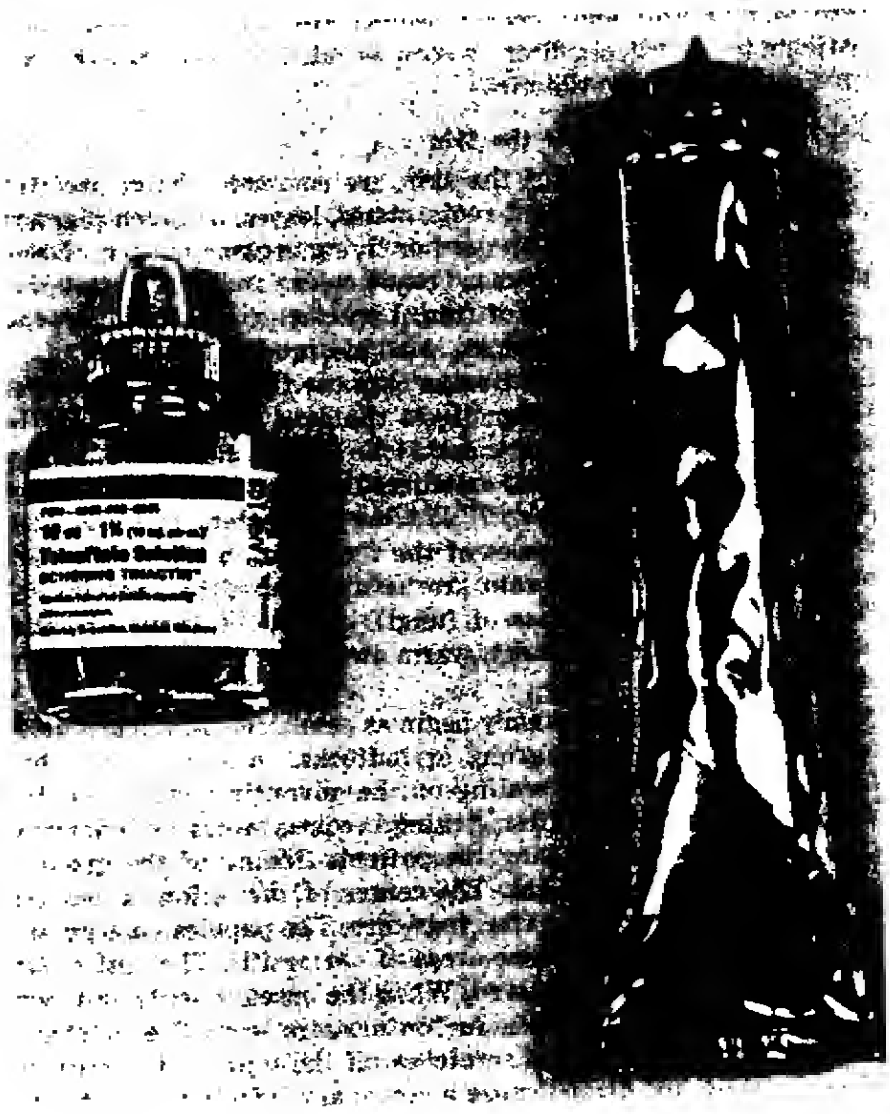


Figure 11–1. Antifungal medication.

11–11. Skin Diseases Caused by Water Immersion

In hot countries, three types of disabling skin diseases are caused by prolonged wetness of the skin.

a. Type 1 is confined to the soles of the feet (fig 11–2) and is called "warm water immersion foot." This type of warm water damage to the skin occurs where there are many creeks, streams, canals, and swamps to cross with dry ground between them. After about 3 days, the thick outer layer of the skin on the soles of the feet becomes white and wrinkled. Some of the creases in the soles of the feet become very tender on walking. During the next 2 or 3 days, the pain becomes severe on walking and the feet swell slightly. When the boot is removed, it may be impossible for the soldier to put it on again because of the pain and swelling. The pain is greatest on the heels and balls of the feet. The soldier complains that it feels as if he is walking on pieces of rope in the boot. The only treatment is to put the man at rest with his boots and socks off, and to see that his skin is dried and stays dry. In a day or so the wrinkling, whiteness and sogginess disappear. The pain leaves, although the soles of the feet remain tender on walking for a few days. In 3 to 6 days, the thick skin on the soles begins to peel.

b. Type 2 water immersion skin disease (fig. 11–3) is called "paddy foot." This condition involves the tops of the feet and legs. It is common where soldiers have to wade through the muddy rice paddies, swamps, creeks, streams, and canals. In that situation, the exposure to water is almost constant. Drying is prevented by men standing in water or mud or having a heavy coating of mud on their boots. This disease is most prevalent when the temperature of the water or mud remains about 85° F. or higher.

(1) It involves the tops of the feet, the ankles, and the legs up to the boot tops. In 2 or 3 days, the skin turns red, a cellulitis appears, and much swelling occurs. Because of the swelling, there is much pain and tenderness, and the skin is stretched and hard. As a result, it is easily bruised and scaped. Large deeper raw spots or abrasions of the skin may be caused by the rubbing of the boot agalnst the soggy skin. The soles of the feet may not be involved, or they may have some conditions typical of warm water immersion foot.

(2) About one-half of the men will develop tender, swollen lymph nodes in the groin. Mild to moderate fever (100° to 102° F.) may be present.

(3) These patients are treated by getting them to a dry area, removing their boots and socks, and putting them at rest with the feet elevated. It is better not to let them sit, but to insist on them lying down. Within 6 hours the edema becomes soft and pitting, that is, dents show after finger pressure. Pain, swelling, vesicles,

Figure 11–2. Type 1 immersion foot.

lymph node swelling, and fever subside after a few days of rest. Then the skin begins to peel off. This peeling lasts about a week. Occasionally, the abrasions and erosions become infected with bacteria, and some patients develop fungal infections.

(4) This type of immersion foot can be prevented in 9 out of 10 soldiers by drying out the wet skin of the feet and legs for 10 hours. Limiting a combat operation in a wet, muddy area to 48 hours, followed by a drying-out period of 24 hours in a dry place, reduces the number of these patients considerably.

Figure 11–3. Type 2 immersion foot. Notice the redness and cellulitis.

c. Type 3 water immersion skin disease involves the upper portions of the legs and groin. Soldiers often must wade through water which is waist-deep and, sometimes, neck-deep. Their trousers may stay wet for many hours. The skin of the groin and inner thighs becomes very red and painful to the lightest touch. The disease is treated—and prevented—by permitting the skin to dry.

11–12. Pediculosis

Pediculosis is infestation of the skin with lice like those in figure 11–4.

a. Pubic (Crab) Louse. The pubic louse, or crab, usually lives in the hair of the pubic region but may be found in hair on other parts of the body. It lays its eggs on the shaft of the hair. These lice may be acquired through sexual intercourse, by wearing crab-infested clothing, or from contact with infested bedding.

(1) The main symptom is itching. Consequently, fingernail scratch marks are seen on the skin. The tiny, dark lice are visible and move violently when pulled off the hair or the skin. They can be seen and identified better with a magnifying glass.

(2) Treat the infestation with 2 percent diazinon powder with lindane powder. Thorough application is important. Let the medication stay on at least 24 hours. Repeat the application after 1 week and again after 2 weeks.

(3) Infestation by lice is prevented by bathing and dusting with pesticide powder (diazinon or lindane) after exposure. Contaminated clothing and bedding also should be dusted thoroughly with a pesticide.

b. Body Louse. The body louse (pediculus) lives and lays eggs on the seams of a person's clothing and feeds on his skin. It lives on human blood and dies in a short time if denied food. The body louse has military importance because it transmits typhus and relapsing fever.

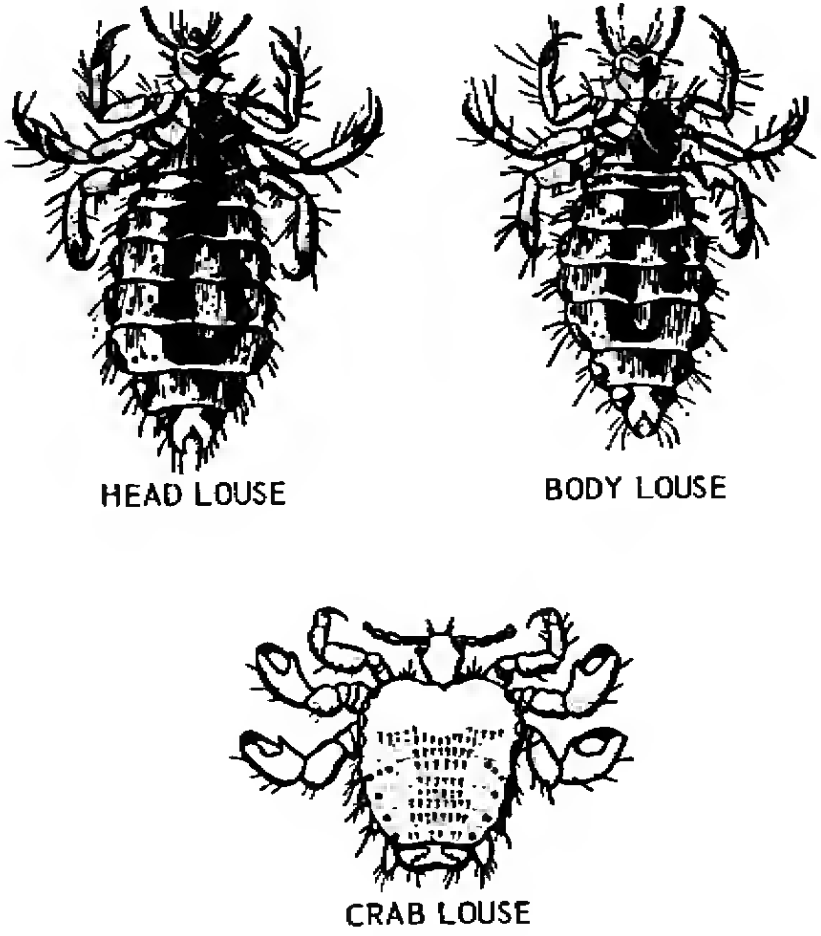


Figure 11–4. Lice.

(1) The adult body louse has six legs. The female louse attaches its eggs to fibers of clothing, usually along seams. The eggs are white, oval-shaped, and about the size of the period at the end of this sentence.

(2) Treat the infestation with pesticide powder the same as for the crab louse (*a* above). In addition, dust the patient's clothing thoroughly especially along the seams.

c. Head Louse. The head louse is similar to the body and crab louse in its habits. It carries no known disease but, because of scratching, it is the indirect cause of secondary infections. Treatment for head louse infestation is the same as for crab or body lice.

11–13. Allergic Conditions

In allergic conditions, the soldier is sensitive to some foreign substances which may contact his skin or be introduced into his body in the food he eats or the air he breathes. A first contact is necessary to produce the sensitization. After that the soldier reacts abnormally to contact with the substance. Some substances can provoke an allergic reaction in anyone contacting them. Others cause an allergic reaction only in persons with a constitutional or inherited predisposition to allergy.

a. Urticaria, or hives, is an allergic reaction to substances which are injected, breathed in, or eaten. Drug allergy is an example of hives. It appears as rounded or irregularly shaped, transitory elevations of the skin. In severe cases, it may appear as general swelling of the face, hands, and other parts of the body. Urticaria is usually associated with much itching and may cover the whole body. Often, its cause is hard to determine, and the reaction may recur. Treatment consists primarily of identifying and avoiding the substance causing the reaction. Other treatments include the use of antihistamine drugs, such as Benadryl, and calamine lotion.

b. Contact dermatitis is an allergic condition due to sensitization of the skin by direct contact with a sensitizing substance. The skin turns red in the contacted area, itches, and small blisters may appear. The affected area may become scaly or may have the appearance of a rash. The blisters may become secondarily infected by bacteria. The reaction appears only in skin which comes in direct contact with the sensitizing substance, although the patient may carry it to other areas of the skin with his hands. The sensitizing substance may be almost anything, such as poison ivy, medicines, clothing, or soaps. Treatment includes removal of the allergen and use of antihistamines, bland lotions and creams, and cortisone creams.

11–14. Differential Diagnosis

Edema and swelling	Allergy, immersion diseases.
Itching	Fungal infections, allergies, or insect bites.
Pus	Bacterial infections, primary or secondary.
Rash	Allergy, infections such as measles or typhus.
Scaly	Allergies, fungal infections.
Ulceration	Viral and bacterial infections, paddy foot, chancre of syphilis.
Reddening of skin	Infections, water immersion, allergies.
Elevated temperature	Bacterial and viral infections, severe allergies.
Blisters	Viral infections, contact dermatitis.
Pain	Infections, allergies, immersion diseases, first and second degree burns.
Nits or eggs on hair shaft	Pediculosis (crabs).
Hives	Allergies.
Swollen face, eyes, or lips	Severe allergies, kidney disease.
Crusty surface	Bacterial and viral infections.
Chills	Bacterial infection.
Red streaks	Lymphangitis.
Swelling of feet	Immersion diseases, heart failure, or kidney disease.
Whiteness and wrinkling	Immersion diseases.

CHAPTER 12

DISEASES OF THE MUSCULOSKELETAL SYSTEM

12–1. Musculoskeletal System

Diseases of the musculoskeletal system are the ones that cripple the most and kill the least. They cause much discomfort. They can lead to permanent deformity, but rarely are they fatal.

12–2. The Skeletal System

a. Skeleton. The skeleton, or bony framework (fig 12–1), in the adult is made up of about 200 bones. Bones are living tissue even though the spaces between bone cells consist of inorganic deposits of calcium. Each bone is a separate organ with its system of blood, lymphatic vessels, and nerves.

(1) The skeleton gives form and stability to the body, protects many organs, furnishes a system of levers which allow the body to move, and manufactures blood cells in the red bone marrow.

(2) The periosteum, a thin membrane, on the outside of each bone, is essential for the nourishment, growth, and repair of bone. The hard, dense, outer layer of bone, known as the compact bone, is thick along the shaft and thin at the ends. It gives bone its great strength.

(3) The inner spongy bone is made of the same material as compact bone but it is more porous. It makes the bone lighter without sacrificing strength. Bone marrow is found mostly in the shafts of long bones. Within bone marrow, fats are stored and new red blood cells are produced.

b. Joint. A joint is a structure which holds together separate bones and provides them a working surface which either permits or inhibits motion.

(1) Most joints of the human body are inside a fibrous joint capsule. Cartilage is found in the capsule at the tips of the ones which meet there. Cartilage acts as a cushion between the bones and helps to reduce friction in the joint. Lining the inside of this capsule is the synovial membrane (fig 12–2). Fluid secreted by the membrane aids in cushioning and lubricating the joint. On the outside of this capsule are tough connective tissues, known as

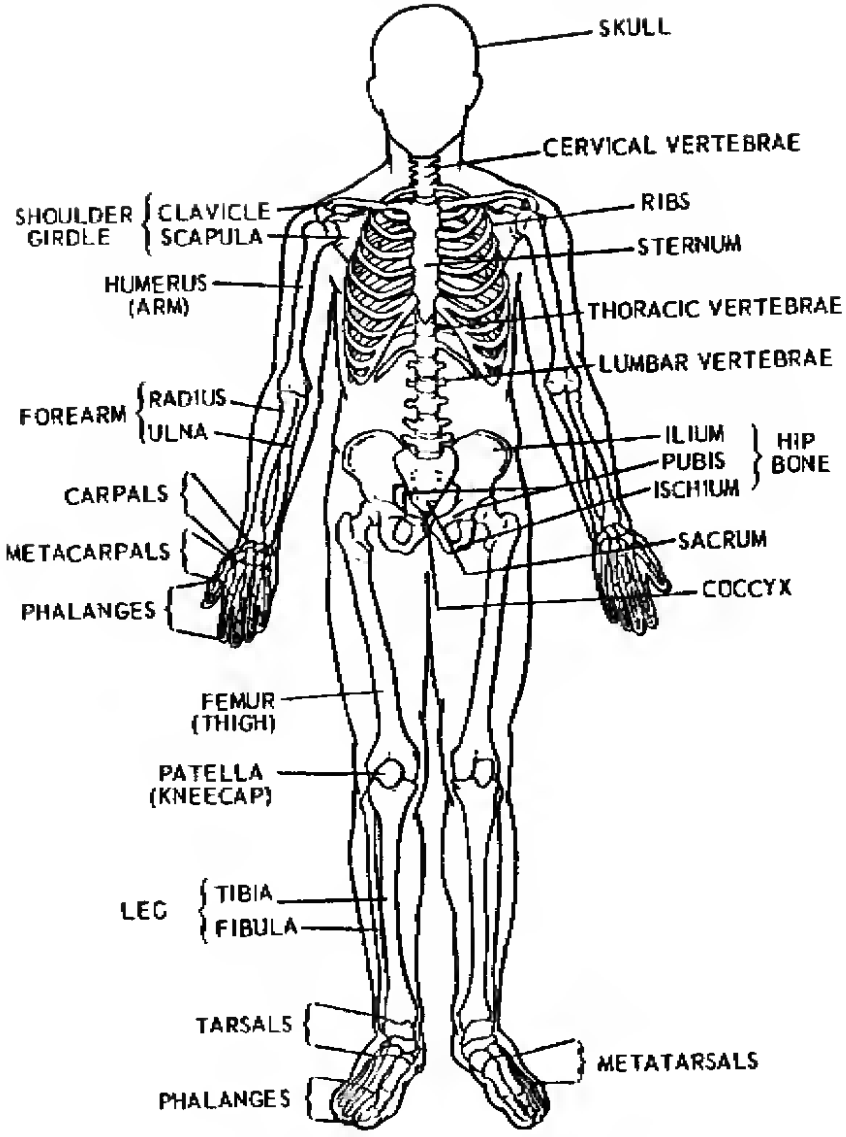


Figure 12–1. The human skeleton.

ligaments, which actively bind the bones together. Most joint injuries involve either the ligaments, synovial membrane, or cartilage.

(2) On the outside of the joint is a closed, slippery, fluid filled sac, called a bursa. Bursae are found between surfaces which glide over each other. For example, they may lie between the tendons and the surfaces on which they glide. (Tendons are connective tissue which join muscle to bones.) Like cartilage and synovial fluid, normal bursae reduce friction.

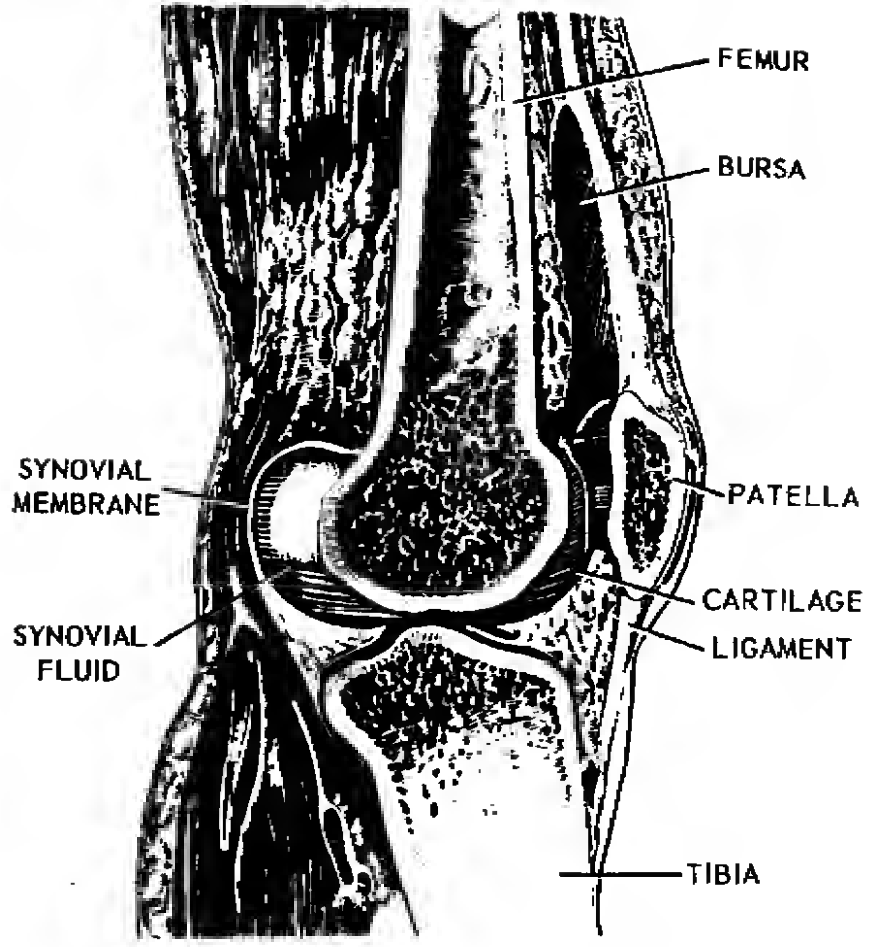


Figure 12–2. The knee joint and its parts.

12–3. Muscles

Muscles are organs of voluntary or involuntary action which provide motion by their ability to contract. Muscle tissue is found throughout the body and makes up 40 to 50 percent of the body's weight. According to their type of nervous control, muscles are classifted as either voluntary or involuntary in action.

a. Voluntary muscle, or skeletal muscle, is called "voluntary" because it is under the direct conscious control of the brain. Most skeletal muscles are attached directly to the skeleton. By contraction, they move various parts of the body. Besides enabling the body to move, the skeletal muscles maintain posture, aid in respiration, and produce most of the body heat.

b. Involuntary, or smooth muscle, is not under the direct conscious control of the brain. Smooth muscles act more or less automatically. They are found in the walls of blood vessels, respiratory

passages, gastrointestinal tract, ureters and urinary bladder, and some glands. They regulate the size of blood vessels, move food through the gastrointestinal tract, regulate the air passages in the lungs, and aid in the transport of urine from the kidneys to the outside.

c. Cardiac (heart) muscle is unique. Physically it resembles skeletal muscle but its function is similar to that of smooth muscle.

12–4. Useful Terms

a. Atrophy. A wasting away resulting in a reduction in size.

b. Ankylosis. Stiff joint; abnormal immobility and consolidation of a joint.

c. Articulation. A joint; joining together of bones.

d. Deltoid. The triangular muscle over the shoulder joint, commonly called the "pin cushion of the Army," which raises and extends the arm.

e. Inter. A prefix meaning situated or occurring between; an example is intercostal, meaning between the ribs.

f. Intercostal Muscles. Muscles between the ribs which aid in respiration.

g. Intervertebral Disk. A layer of cartilage, shaped like a round plate, which acts as a cushion between adjacent vertebrae.

h. Myo. A prefix denoting relationship to muscle, as in myositis, inflammation of a voluntary muscle.

i. Osteo. A prefix denoting relationship to a bone or bones, as in osteomyelitis, inflammation of bone marrow and bone.

j. Sign. A measurable objective occurrence of the body, such as pulse, temperature, respiration, or blood pressure.

k. Symptom. A subjective complaint or feeling expressed by a patient and not measurable. Examples of symptoms are pain, dizziness, nausea, cyanosis, jaundice, and ache.

l. Trauma. A wound or injury.

12–5. Diseases of Joints

a. Arthritis. Arthritis means inflammation of joints. The inflammation may lead to deformity of the joint. Symptoms are pain, swelling, redness, and stiffness. Other symptoms and signs may include infections elsewhere in the body in the case of infectious arthritis and a low grade fever. After repeated episodes of inflammation, a joint may become permanently stiff with limitation in motion due to scarring of the joint surfaces.

(1) Infectious arthritis is produced by various bacteria including the staphylococcus, streptococcus, pneumococcus, gonococcus, and meningococcus. Usually the infecting organisms are carried to the joint in the blood from infection elsewhere in the body.

(2) Degenerative joint disease, also called osteoarthritis or hypertrophic arthritis, is a chronic arthritis of middle-aged and elderly people. The cause is unknown. Continued joint injury may contribute to the disease. Injury causes the joint cartilage to split and thin out, with a bony spur developing at the articular ends of the bone. Joints are stiff and painful.

(3) Rheumatoid arthritis, or atrophic arthritis, is chronic inflammation of the synovial membrane and the joint capsule. The articular cartilage is destroyed and the bones atrophy at their articular ends. Swelling and pain occur in joints, marked deformity results, and ankylosis and muscular atrophy occur.

b. Rheumatic Fever. Active rheumatic fever may involve only joints, but often involves the heart or nervous system. Rheumatic fever is an allergic reaction to streptococcus infection. The joints become swollen and painful. Usually the joint disease is migratory; that is, one or two joints are affected for a few days, they get better, and then arthritis appears in another joint. Fever is also present. A heart murmur may be present if the heart is involved or involuntary movements may occur if the nervous system is involved.

c. Bursitis. Many bursae (para 12–2*b*(2)) are present in the body, especially over bony prominences. Repeated trauma or possibly an infection causes inflammation in bursae. Fluid accumulates in the bursae, with pain and occasionally redness. Diagnosis is based on tenderness over a bursa. The most common sites for bursitis are over the elbow, knee, and shoulder. Treatment is with aspirin. The disposition is routine evacuation.

12–6. Myositis

Myositis is an inflammation of muscle caused by infection, trauma, or chemical irritation. The most common type of myositis is due to viral infection, with involvement of the back muscles in particular. Inflammation produces muscle spasm, which results in pain, stiffness, and pain on motion. Usually there are no signs or symptoms other than the localized muscle symptoms.

a. A patient with myositis often gives a history of exposure to inclement weather, a recent upper respiratory infection, or trauma to a muscle mass. Many times there is no history to suggest the cause of the disturbance. A frequently encountered example is referable to the neck. The patient relates usually that he awakes with a painful, stiff neck. The pain is unilateral and the least movement of the neck brings on a spasm of the involved muscles of the neck and shoulder and a sudden occurrence of pain. Other muscle masses such as the muscles of the shoulder, the neck, or the chest are subject to myositis. Examination will reveal the involved muscles to be tender and hard due to spasm.

b. Treatment in the field is limited to aspirin and heat. Evacuation to a medical officer is indicated when the tactical situation permits.

12–7. Abnormal Back Conditions

a. Low Back Pain. Backache is one of the commonest symptoms referable to the musculoskeletal system. Backache has many causes, including the lifting of heavy objects which may produce a sprain or a strain, inflammation of muscle, and diseases of organs in the chest, abdominal cavity, or pelvis. It is also a common neurotic complaint. If a soldier has a mild backache and it is not associated with another symptom, such as fever, nausea, diarrhea, or paralysis, you may treat him in the field for a short time with aspirin and back-stretching exercises. If the backache is severe, persistent, or associated with other signs and symptoms, you should evacuate the patient to a medical officer when the tactical situation permits.

b. Acute Backache. This backache is usually caused by trauma. The trauma may result from the lifting of heavy objects causing a strain of the back muscles, or from a blow or fall, that injures the back. Acute backache from strain is localized in the lumbar region and aggravated by motion of the spine. A patient with acute backache walks very cautiously, stooped forward so that he does not jar or move his spine. Mild acute backache due to trauma usually is not hard to manage. Treatment in the field should be limited to analgesics and as much rest as possible for a few days. A patient with persistent backache should be evacuated to a medical officer. Acute backache can result also from meningitis, encephalitis, prostatitis, kidney or bladder infections, and localized infections about the vertebral column. Meningitis and encephalitis usually involve severe headaches and a stiff neck. Infections in the urinary tract have the additional urinary symptoms of frequency, urgency, and dysuria (painful or difficult urination). Severe direct tenderness is present over localized back infections. Kidney stones also produce severe back pain which radiates from the lumbar region down into the groin and the inner aspects of the thigh on the involved side.

c. Chronic Backache. This is backache which is present intermittently or constantly for weeks, months, or longer. A chronic backache may result from any conditions, except meningitis or encephalitis, that cause acute backache. Arthritis of the spine and trauma are notable causes of chronic backache. Trauma may cause not only a chronic low back strain but a herniated disk or a ruptured disk. The backache of a patient with a herniated or ruptured disk is most often lumber in location, with pain radiating down the back of one or both legs when the patient strains, coughs, or sneezes. Arthritis may involve any portion of the vertebral column. Chronic low back pain may be due to poor posture or repeated trauma to the back. Signs and symptoms may be the same as for acute trauma or arthritis. Treatment in the field is limited to analgesics. You may suggest limitations in duty assignments.

12–8. Differential Diagnosis

Swelling of joints	Arthritis (all types), rheumatic fever, sprains.
Pain	Arthritis (all types), rheumatic fever, infections, inflammation.
Joint pain and stiffness, improves with activity	Rheumatoid arthritis.
Joint pain and stiffness, worsens with activity	Osteoarthritis and other types of arthritis except rheumatoid arthritis; sprain; fracture; gout.
Redness	Arthritis, bursitis.
Stiffness	Arthritis.
Elevated temperature	Rheumatic fever, all infections.
Infections elsewhere in the body	Meningitis, encephalitis, kidney, bladder, prostate.
Stiff neck, headache	Meningitis, encephalitis.
Back pain radiating down leg	Slipped disc, kidney stone.
Deformity	Osteoarthritis, rheumatoid arthritis.
Is condition migratory?	Rheumatoid arthritis, rheumatic fever.
Pain on motion	Arthritis, bursitis, myositis.
Is pain localized?	Arthritis, bursitis, localized infections, trauma.
Nausea or vomiting *	Viral myositis.
Diarrhea *	Viral myositis.
Urinary symptoms *	Urinary infections including prostatitis.
Muscle spasms	Muscle strain.

* Associated with musculoskeletal symptoms or signs.

CHAPTER 13
DISEASES OF THE RESPIRATORY SYSTEM

13–1. Exchange of Gases

The cells of the body require oxygen for life. Oxygen is used by the cells and then converted to the waste gas, carbon dioxide, which is removed from the body. Oxygen and carbon dioxide are continually being exchanged, both between the body and the atmosphere and within the body. The respiratory system performs this essential exchange of gases, taking oxygen from the air and releasing carbon dioxide into the air.

13–2. Structure and Function of the Respiratory System

The respiratory system consists of the nose, paranasal air sinuses, pharynx, trachea, bronchi, lung, and diaphragm. Figure 13–1 depicts the upper respiratory organs.

a. The nose provides a passage for air, warms and moistens the inspired air, and removes dust. Fine hairs filter out coarse particles of dust and the lining of the mucous membrane traps fine particles. The mucous membrane also warms and moistens the air.

b. Paranasal air sinuses are passages lined with mucous membrane which warm and moisten the air and act as resonance chambers for the voice.

c. The pharynx, or throat, connects the nose and mouth with the lower air passages and esophagus (fig 13–1). It contains masses of lymphoid tissue, such as adenoids and tonsils.

d. The larynx, or voice box, connects the pharynx with the trachea. It forms the "Adam's apple" in the neck. During swallowing, the epiglottis closes the larynx, keeping food or liquid out of the trachea.

e. The trachea, or windpipe, is a tube which carries air from the larynx to the bronchi. It is held open by rings of cartilage.

f. The trachea ends as it branches into two bronchi, one bronchus going to each lung. These bronchi then branch into many smaller bronchi and even smaller bronchioles as they carry air to and from the millions of tiny air sacs (alveoli) in the lungs (fig 13–2).

g. The two lungs (fig 13–2) are the essential organs of respira-

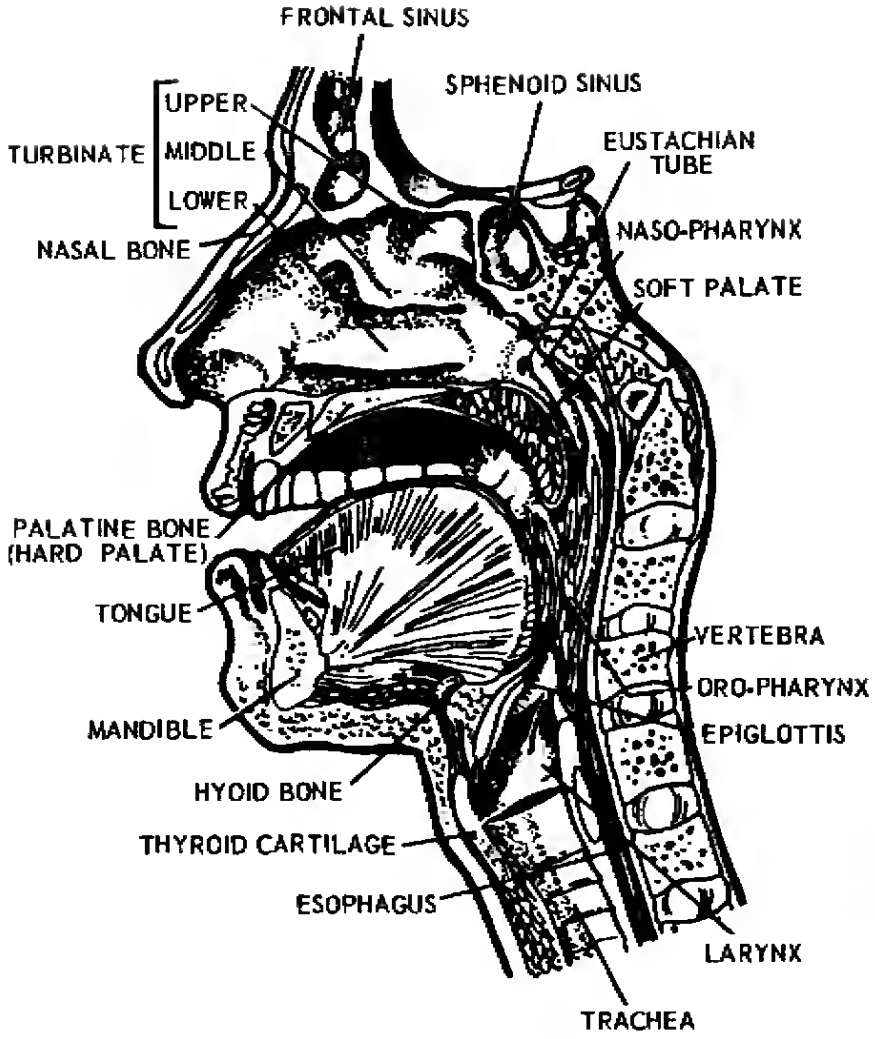


Figure 13–1. Upper respiratory organs.

tion. The right lung is divided into three lobes; the left lung into two. The lungs lie in the thoracic cavity, each lobe enclosed by a membranous sac formed of two layers of serous membrane called pleura. One layer of the pleura, the pulmonary visceral layer, lies next to the lungs. The other layer, the parietal pleura, lines the thoracic cavity. The portions of the two layers which separate the lungs from the heart are the mediastinal pleurae. Between the parietal and visceral pleurae is a small amount of fluid which acts as a lubricant and a vacuum seal. If air or liquid enters the pleural sac and creates a space between the pleural surfaces, the affected lung is compressed and partially collapses. The lung is a spongy,

lightweight organ consisting mostly of "empty" air sacs called alveoli. It is in these air sacs that oxygen is absorbed into the blood and carbon dioxide is released from the blood.

13–3. Useful Descriptive Terms

a. Antitussive. Relieving or preventing cough.

b. Apnea. Absence of respiration.

c. Atelectasis. A partial or complete collapse or airless state of the lungs.

d. Breast Bone. The sternum.

e. Bronchitis. Inflammation of the bronchi.

f. Cyanosis. A bluish discoloration of the skin, especially around fingernails, toenails, lips, and ear lobes, due to lack of oxygen in the blood.

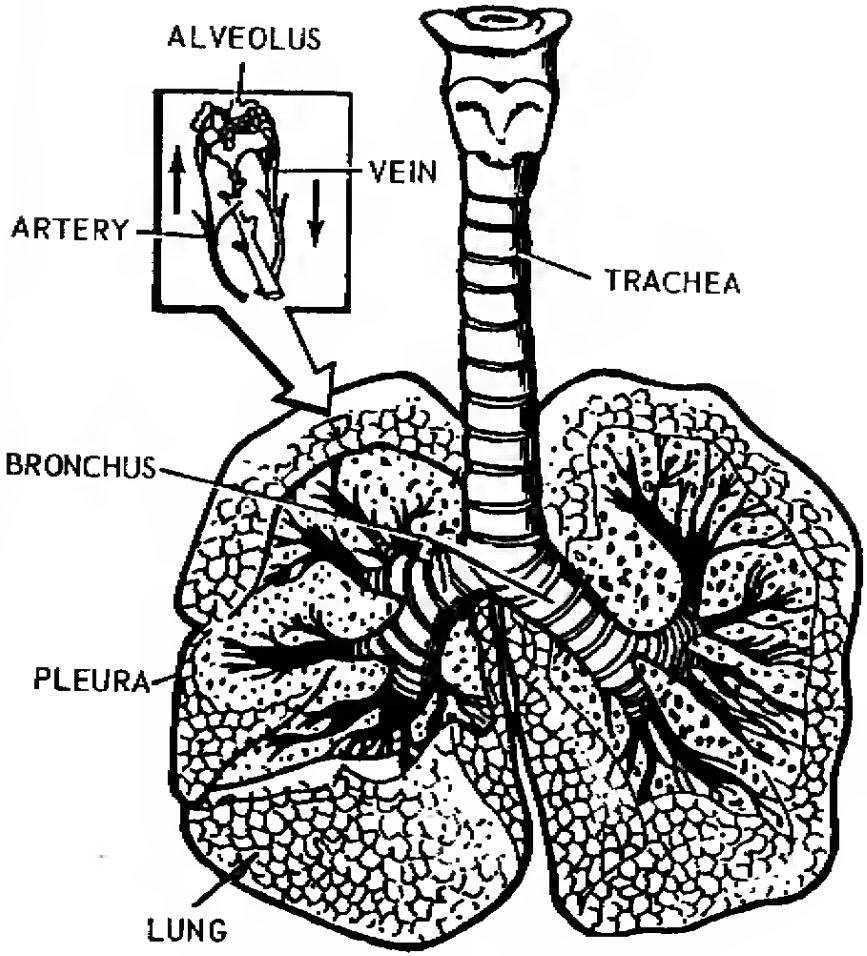


Figure 13–2. The lungs and air passages.

g. Embolus. A clot or other substance such as air or fat which travels through the circulation, lodges in a vessel, and obstructs the flow of blood.

h. Hemoptysis. The coughing up of blood or bloodstained sputum.

i. Infarct. Death of tissue because of a lack of blood supply.

j. Malaise. A vague feeling of bodily discomfort.

k. Neuralgia. Pain which extends along the course of one or more nerves.

l. Pallor. Paleness; absence of skin coloration.

m. Pleurisy. Pain due to inflammation of the pleura (pleuritis).

n. Pleural Effusion. Presence of excess fluids in the pleural cavity.

o. Pneumothorax. Air in the pleural cavity.

p. Pulmonary. Pertaining to the lungs.

q. U.R.I. Upper respiratory infection.

13–4. General Signs and Symptoms of Respiratory Diseases

a. Cough. An adequate history is essential for the proper evaluation of a patient with a cough. If the patient does not volunteer the information, ask him how long the cough bas been present, whether it has been constant or intermittent, when it is worse, what aggravates it, the color and amount of sputum produced, whether associated symptoms such as shortness of breath are present, and whether he bas a history of heart or lung disease. A cough will be eiher nonproductive (dry) or productive.

(1) A dry cough is seen early in the course of acute hronchitis, pneumonia, tuberculosis, and carcinoma (cancer) of the lung, or as the result of aspiration of a foreign body or an irritant into the airway. As any of these conditions persists, the sputum usually becomes mucoid (thick and white) purulent (usually yellow, green, or brown). Asthma produces large amounts of mucoid sputum. Sometimes pneumonia and bronchitis produce purulent sputum soon after the start of the dry cough.

(2) A productive cough is one in which the patient coughs up sputum. It is important to make sure the patient is talking about sputum and not saliva, which is always present. Sputum comes from the trachea or from deeper in the air passages. Sputum is usually classified as mucoid, purulent, or bloody. Mucoid sputum is typical of mild bronchial infections and allergies such as asthma. Purulent sputum occurs with bacterial infections such as in pneumonia or severe bronchitis. Bloody sputum may simply be streaked with small amounts of blood. This is a common result of any acute inflammation of the air passages, especially when a hacking cough is present. Sputum which is completely bloody generally has a more serious implication. It is associated with traumatic chest injury, lung cancer, and tuberculosis.

(3) Management of a cough depends on its cause, type, severity, duration, associated signs and symptoms, and type of sputum. A patient with a cough which has been present intermittently or constantly for more than a week should be referred to a medical officer for evaluation. A dry, harassing cough associated not with temperature elevation but with other symptoms suggestive of a common cold may be relieved by a teaspoonful of terpin hydrate every 4 hours. The same treatment is proper for a cough producing small amounts of mucoid sputum. A patient producing a purulent sputum has a bacterial infection somewbere in his tracheobronchial tree, perhaps an acute bacterial bronchitis or pneumonia. He should he sent to a medical officer for evaluation. Any patient with hloody sputum must be seen hy a medical officer.

b. Dyspnea (Shortness of Breath). Dyspnea is usually due to some form of body oxygen shortage. It occurs temporarily after exercise, for example. It may also be the result of diminished oxygen content in the surrounding air. This is best illustrated by tbe shortness of breath experienced by unacclimatized troops while working at an altitude bigher than they are accustomed to. Any disease or injury that keeps enough oxygen from getting into the blood by the lungs can produce dyspnea. Likewise, a disease or injury that prevents proper circulation of the blood and oxygen to all parts of the body will cause dyspnea. A condition that impairs the nervous control of respiration so that breathing is no longer automatic also will cause dyspnea. Persistent dyspnea in the absence of strenuous exercise is a serious condition requiring evaluation hy a medical officer. Consequently, if a patient complains of shortness of breath, ask how long the symptom has been present and whether he has just finished exercise. Emotional upset can produce dyspnea, but if it is persistent, the patient should be referred to a medical officer.

c. Chest Pain. Pain in the chest originates in the heart, chest wall, or abdominal organs. It may also be psychogenic—that is, produced by the mind in the absence or organic disease. Careful questioning about the nature of the pain will help you determine what is causing the chest pain. Pain involving the heart (cardiac pain) is discussed in paragraph 14–9.

(1) Pleural pain is caused by irritation or inflammation of the parietal pleura (pleurisy). It is due most often to infections, trauma, or cancer spreading from the lungs to the pleura. Pleural pain is usually characteristic. It may be present in either side of the chest and is well localized. The pain is aggravated by a deep inspiration, coughing, or sneezing, and is sticking, stabbing, or

cutting. It disappears if the breath is held in expiration. Often associated signs and symptoms are cough, sputum, fever, and dyspnea. A patient with pleuritic pain should be evacuated for evaluation.

(2) Pain arising in the outer structures of the chest wall (skin, muscles, ribs) is usually aggravated by deep inspiration, but disappears when the breath is held. Among the possible causes of this pain are a broken rib, intercostal muscle sprain, herpes zoster, inflamed rib cartilages, and nerve root irritation. If the patient twists or bends the thorax laterally while holding his breath, the pain recurs. The pain also often encircles one or both sides of the thorax, and a localized area of tenderness can be elicited in the region of the pain. Cough and fever may not be present. Dyspnea may occur. The pain is managed by local application of heat several times daily for ½ hour, by massage, and by administration of two aspirin every 4 hours. If the patient does not improve within a week, he should be seen by a medical officer.

(3) Pain referred to the chest may be felt in any area from the tip of the shoulder to the lower rib margin. It is usually due to disease of abdominal organs near the diaphragm, such as the liver, gallbladder, stomach, transverse colon, or spleen. It is differentiated from disease in the chest by the presence of abdominal tenderness and symptoms referrable to the abdomen, such as nausea, vomiting, distention, constipation, or diarrhea. Refer the patient to a medical officer as soon as possible. Do not give him anything by mouth or to relieve the pain.

(4) Psychogenic chest pain is precipitated by anxiety. It may mimic cardiac pain. The correct diagnosis is based upon your ability to question the patient carefully about upsetting events, duration of the pain, and what brought it on. The better you know the men you serve, the better you can detect psychogenic symptoms. One common cause of psychogenic chest pain is news that a close relative or friend has suffered a heart attack.

(5) For information on cardiac pain, see paragraph 14–9.

13–5. Upper Respiratory Infections

a. Common Cold (Acute Coryza). The common cold is caused by a virus. It is characterized by a watery, nonpurulent nasal discharge. Other symptoms include coughing, hoarseness with laryngitis, blockage of nasal passages, and sore throat. The patient may also have a mild fever of less than 101° F., general feeling of discomfort, and easy fatigability. The ordinary cold persists for several days to a week, gradually improving after 2 to 3 days. There is no specific treatment for coryza. Symptomatic treatment that may be used includes aspirin, antihistamines, cough syrup, increased intake of fluids, and rest.

b. Pharyngitis and Tonsillitis. These conditions are caused by invasion of the mucous membrane of the throat or tonsils by viruses or bacteria, especially streptococcus. Both conditions are characterized by severe sore throat, fever, intense inflammation of the throat, malaise, weariness, and often swelling of the lymph nodes and tenderness in the neck. The throat will show a fiery redness of the pharynx or the tonsils, or both. In streptococcal infections, white spots of pus may be present on the tonsils. Occasionally, an infection spreads from the tonsils to localize in the tissue around them, causing a peritonsillar abscess. Specific therapy includes antibiotics for bacterial pharyngitis and tonsillitis. Very helpful for sore throat of any cause is warm salt water gargle. Have the patient mix a teaspoonful of salt into a glass of warm water and gargle it for 5 to 10 minutes four times a day.

c. Influenza (Flu, Grippe). Influenza is similar to the common cold except that the symptoms are more severe. The primary cause of influenza is a virus; however, many secondary infectors may invade the body weakened by the influenza virus. The patient is listless, has headache and muscular aches, particularly in the back, and may feel very ill. His fever is usually moderately high, 101° to 103° F. He may also have a sore throat, watering eyes, nasal discharge, cough, nausea, and vomiting. A patient with the flu should be evacuated. Treatment is directed toward relieving the symptoms. Specific treatment for any secondary infection should be started early by the medical officer.

13–6. Lower Respiratory Infections

a. Acute Bronchitis. This is an inflammation of the mucous membrane lining the airways (bronchi) into the lungs. It may be caused by viral or bacterial infections or by physical or chemical agents. The outstanding symptom is cough. Other symptoms are general symptoms of infection such as fever and malaise. The cough may be nonproductive or productive of either mucoid or purulent sputum. Bronchitis usually is a mild disease of short duration, but it may progress into pneumonia in a debilitated patient. It is treated with rest, fluids, cough mixtures, and specific antibiotics prescribed by a medical officer.

b. Bacterial Pneumonia.

(1) The typical symptoms of bacterial pneumonia are chills, fever, cough, pain in the chest, and greenish-yellow sputum which may be streaked with blood. The temperature is high (102° to 104° F.). Pulse is fast (120–140). Respiration is fast. In a severe case, breathing is difficult and cyanosis is present. Chills are often the first symptom, appearing suddenly in an apparently healthy individual without previous symptoms. The pain in the chest is often severe and aggravated by breathing and coughing (pleuritic).

(2) You cannot treat pneumonia adequately in the field. The patient must be evacuated to a medical treatment site with laboratory facilities. Evacuation is usually by routine or priority, depending on the severity of the case.

c. Virus Pneumonia. This is also called primary atypical pneumonia. The symptoms are similar to bacterial pneumonia, except that they are often less severe. Therefore, diagnosis is more difficult without X-rays. The onset of virus pneumonia may be more gradual than that of bacterial pneumonia. The temperature is often lower and more variable than in bacterial pneumonia. The cough is seldom productive. Chest pains are described as more of an ache. Pulse and respiration are slower. An X-ray is often necessary to conclude a diagnosis of virus pneumonia. The patient must be evacuated to a medical treatment facility with complete laboratory and X-ray capabilities.

13–7. Asthma

Asthma is a chronic, recurrent allergic disease usually beginning in childhood. The patient is sensitive to an agent such as pollen which, when it enters his body, causes constriction of the smooth muscles of the bronchial tree, swelling of the mucous membrane lining, and increased secretions of the glands in the bronchial walls. This results in partial blockage of the air passages. The patient must forcibly exert his respiratory muscles to breathe. Asthmatic attacks usually last about 2 to 4 hours.

a. Characteristic of asthma is the wheezing noise of air being forced through the patient's narrowed and wet bronchial tree. Coughing spells often accompany the attack.

b. Ideal treatment of asthma consists of isolating the substance producing the reaction and either having the patient avoid the substance or desensitizing him against it. Desensitization is the procedure of administering the substance (foreign protein) in progressively larger doses as the body gradually accommodates to it. Acute asthmatic attacks are treated with antihistamines such as Tedral, Benadryl, or Pyrabenzamine. This is because large amounts of histamine are released during an attack and the histamine actually produces the symptoms. In extremely severe attacks, injections of epinephrine may be required to keep the airway open.

c. The best way to prevent asthma is to avoid the causative allergen. A soldier may need to be evacuated from a certain area if the allergen is abundant there.

13–8. Hyperventilation

Hyperventilation means abnormally rapid breathing rate. It is a common result of anxiety or fear, typical in combat situations. The patient may not be aware he is breathing too rapidly, and if the hyperventilation is prolonged, a series of unusual and frightening symptoms occur. The rapid breathing produces an excess of oxygen and not enough carbon dioxide in the blood. The resulting shortage of carbon dioxide in the blood produces numbness of the hands, fingers, and other parts of the body; prickling of the skin; trembling; racing of the heart; light-headedness; fainting; cramping of muscles; curling of the fingers and toes; and extreme anxiety and apprehension. These symptoms frighten the patient and cause him to breathe even faster. This accelerates the symptoms, resulting in a vicious cycle. Hyperventilation is treated by slowing the breathing and elevating the concentration of carbon dioxide in the lungs. The patient must be reassured and firmly encouraged to slow his breathing. A paper bag, a poncho, or a field jacket, may be placed over the patient's nose and mouth to trap the exhaled carbon dioxide, forcing him to rebreathe it. The cover should be left in place for about six respirations and removed for another six. This cycling should continue until he is improved.

13–9. Differential Diagnosis

Dyspnea	Asthma, pneumonia, deceased O_2 supply.
Chill	Pneumonia, malaria.
Productive cough	Bronchitis, pneumonia, asthma.
Nonproductive cough	Bronchitis, cold, flu, pneumonia, foreign body.
Watery sputum	Bronchitis, cold, flu.
Blood-streaked sputum	Pneumonia, tuberculosis, cancer.
Chest pain on exertion	Cardiac, chest wall pain (chap 14).
Chest pain less when holding breath	Pleuritic pain, chest wall pain.
Chest pain with abdominal symptoms	Referred chest pain.
Rapid breathing	Pneumonia, asthma, bronchitis, hyperventilation.
Cyanosis	Pneumonia (severe), asthma (severe), chemical poisoning.
Sore throat	Bacterial or viral pharyngitis or tonsillitis.
Allergy	Asthma, hay fever.
Slightly elevated temperature	Viral infections.
High temperature	Bacterial infections.
Fast or weak pulse	Pneumonia, asthma, shock.

CHAPTER 14

DISEASES OF THE CIRCULATORY SYSTEM

14–1. Circulatory System

Diseases of the circulatory (cardiovascular) system—the heart and the blood vessels—are the leading cause of death in the United States. They account for more deaths than the next five most common diseases combined. Every cell in the human body must have oxygen almost continuously to live. The circulatory system delivers life-sustaining oxygen in its blood to the cells. In addition, it carries the waste gas, carbon dioxide, away from the cells to the lungs for release into the air. In exchange, the blood picks up more oxygen to carry to the body cells. The main components of the circulatory system are the heart, which pumps the blood; the blood vessels (arteries, veins, and capillaries) which carry the blood; the blood itself; and the lymphatic system.

14–2. The Heart

The heart is a four-chambered pump consisting mainly of muscle tissue. It is about the size of two clenched fists (fig 14–1). Two of the chambers receive blood and two pump blood. The chambers on the right side are filled with blood containing much carbon dioxide. The upper chamber (right atrium) receives blood from the body while the lower chamber (right ventricle) pumps it to the lungs. The left chambers are filled with blood rich in oxygen. The upper chamber (left atrium) receives blood from the lungs while the lower chamber (left ventricle) pumps it to the body. Valves at the outflow sites and between the chambers allow the blood to flow in the correct direction only.

14–3. Arteries

Arteries convey blood away from the heart. Very small arteries are called arterioles. The system of arteries and arterioles is like a tree with a large trunk giving off branches which repeatedly divide and subdivide, becoming progressively smaller. When the heart contracts, it pumps blood into the arteries. The artery from the right ventricle to the lungs is the pulmonary artery. The artery from the left ventricle is the aorta. The aorta then branches to

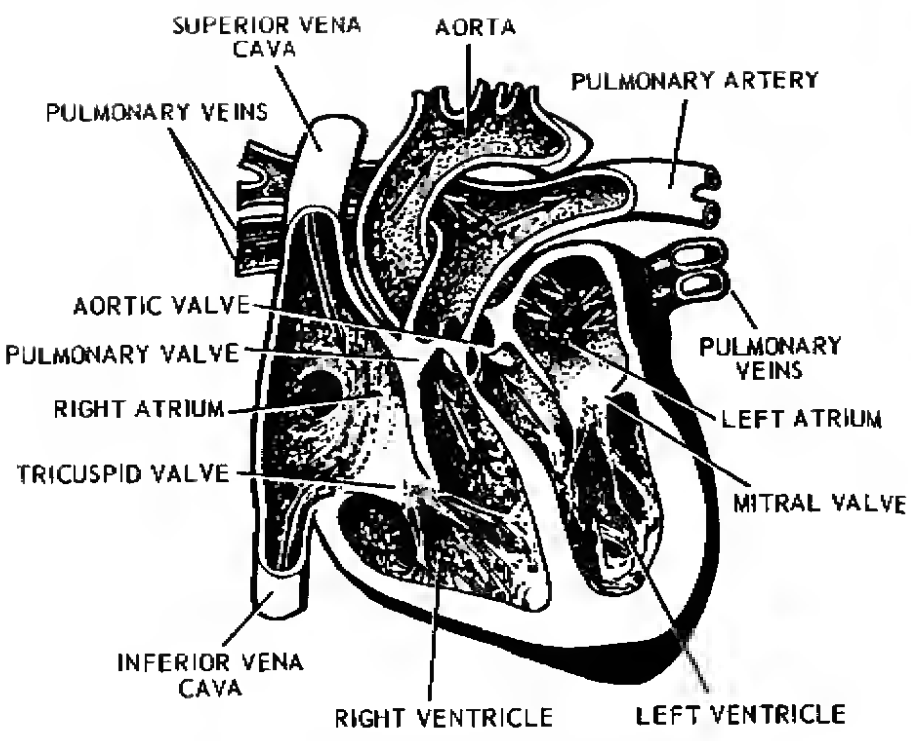


Figure 14–1. The heart and its parts.

supply all organs in the body. Pulse rate is measured by feeling blood pulse through an artery.

14–4. Veins

Veins return blood to the heart. The vein emptying directly into the right atrium is the vena cava. The veins emptying into the left atrium are the pulmonary veins. Very small veins are called venules. Veins are characterized by thin walls, low pressure, and valves which keep blood from flowing backward. Blood is moved through the veins by a combination of pressure from behind, squeezing of the veins by muscular contraction on them, and valves which allow the blood to move only toward and not away from the heart.

14–5. Capillaries

Capillaries, the smallest blood vessels, carry blood from the arterioles to the venules. Their walls are made of a thin layer of tissue. The thin wall permits exchange of fluid, oxygen, and carbon dioxide between the blood and the tissue cells.

14–6. Blood

a. Function. Blood functions primarily as a way of transporting substances from one part of the body to another. Blood carries oxygen from the lungs to the cells, carbon dioxide from the cells to the lungs, food from the digestive tract to the cells, and wastes from the cells to the kidneys. Blood also functions in fighting infection, maintaining the body's temperature, and maintaining the body's chemical balance.

b. Components. Blood is made of plasma and cellular elements. The cells include red blood cells, white blood cells, and platelets, and comprise about one-half the volume of blood. Plasma, the fluid part of blood, forms the other one-half. Plasma is a clear, straw-colored liquid containing many substances in solution. Among them are water, gases, protein, fat, carbohydrates, inorganic salts, enzymes, hormones, and waste products.

(1) Red blood cells carry oxygen from the lungs to the tissue cells. Red blood cells are formed in the bone marrow. In the average adult, they number about 5,000,000 per cubic millimeter of blood. Red cells contain a pigment called hemoglobin, a compound of iron salt and protein, which gives the cell its color. In the presence of oxygen, hemoglobin becomes a brighter red. Therefore, blood in the left atrium just returning from the lungs will be much brighter red than blood in the veins just returning from the tissue.

(2) The function of white blood cells is to fight infection. They are able to ingest and destroy bacteria. They are also capable of ameboid movement and can pass through capillary walls into surrounding tissues. An area of infection, such as a boil, is characterized by a great increase of white blood cells (leukocytes), which gather about the site and try to destroy the bacteria. Pus in a boil is mostly white cells, with bacteria and dissolved tissue. Diseases involving bacterial infection are generally accompanied by an increase in circulating white blood cells, as in appendicitis. White blood cells are formed in the bone marrow and number about 5,000 to 10,000 per cubic millimeter of blood.

(3) The main function of blood platelets is to aid clotting, or coagulation, of blood. Coagulation is the body's method of preventing excessive loss of blood when blood vessels are broken or cut open. Undisturbed blood circulates in its vascular system without clotting. When the blood leaves its natural environment, certain physical and chemical factors are changed, and the platelets break up to start the clotting process. Platelets are also formed in the bone marrow. They number about 250,000 per cubic millimeter of blood.

14–7. Lymphatic System

The lymphatic system consists of the lymph, lymph vessels, lymph nodes, and associated organs including the spleen.

a. Lymph is the fluid which passes out of the capillaries and bathes every cell in the body, supplying nutrient substances and

carrying away wastes. It returns to the bloodstream in the lymph vessels.

b. Lymph vessels start as open-ended ducts within the tissue spaces. As they travel up toward the heart, they unite with other lymph capillaries to form larger lymph vessels resembling veins. Lymph fluid drains from spaces between tissues into these vessels to be returned to the circulatory system. On the way, it passes through one or more lymph nodes.

c. Lymph nodes are small, oval bodies of lymphoid tissue which lie along the course of lymph vessels. Lymph nodes act as filters for the removal of infective organisms from the lymph stream. Normally lymph nodes cannot be felt through the skin. However, infections can cause lymph nodes to become inflamed and enlarged. Enlarged nodes may sometimes be felt in the groin, armpit, or neck following infections in those areas. Lymph vessels may become infected also in the area of local infections and appear as red streaks in the skin leading away from an infected wound. Other diseases of the lymphatic system are rare and will not be discussed here.

14–8. Useful Descriptive Terms

a. Anemia. A condition in which the number of red blood cells is below normal.

b. Aneurysm. Localized dilation of an artery.

c. Aorta. The major artery of the body.

d. Arterial Pressure. The force which causes blood to flow in the arteries away from the heart.

e. Bradycardia. Abnormal slowness of the heart beat.

f. Cardio. A word stem indicating the heart, as in cardiology—study of the heart.

g. Carotid Arteries. The principal arteries of the neck; they supply blood to the brain, face, and scalp.

h. Congenital. Existing at or before birth; usually refers to an abnormal condition.

i. Constriction. A narrowing or closing of a blood vessel; a feeling of tightness or pressure, as in the chest.

j. Coronary Arteries. Arteries supplying blood to the tissues of the heart.

k. Digitalis. A drug which increases the efficiency of contraction in a failing heart.

l. Edema. An excessive collection of watery fluid in the tissues.

m. Embolism. The occlusion or blocking of an artery by a clot (embolus) which has traveled through the circulation from another area of the body.

n. Hem, Hema, Hemo, Hemato. Combining forms (stems) meaning blood. Examples: hematology, study of blood; hemoptysis, coughing of blood.

o. Hematoxic. Poisonous to blood.

p. Hemostat. An instrument for constricting a blood vessel to stop flow of blood.

q. Muscle Tone. A state of partial tension (contraction) always found in muscles.

r. Myocardial Infarction. Death of the heart muscle as a result of coronary occlusion (loss of blood supply).

s. Phlebo. A combining form indicating the vein, as in phlebitis, inflammation of a vein.

t. Stenosis. Constricting of a channel.

u. Thrombus. A blood clot inside a vessel which may block flow of blood.

14–9. Heart Attack

Although there are several diseases of the heart which can occur, most are uncommon and of no concern to you. However, a heart attack can occur anywhere, any time, without warning, and it may be fatal.

a. Signs and Symptoms. Heart attack is produced when one of the blood vessels to the heart muscle (coronary arteries) becomes blocked. The part of the heart which is deprived of blood dies rapidly. This usually produces severe chest pain which is generally described as "crushing," and is present in the middle of the chest. Because the heart is damaged, the pulse is often weak, rapid, and irregular. The patient appears severely ill. Sometimes heart attacks are preceded for months or years by many brief episodes of similar but milder chest pain occurring with exertion. This exertional chest pain, called "angina pectoris," indicates narrowing of the coronary arteries.

b. Treatment. The patient with a heart attack needs immediate hospitalization and should receive urgent evacuation. Until evacuation, rest, sedation, and oxygen are the best measures. Administer morphine (¼ grain) for the chest pain. Angina pectoris should be fully evaluated by a medical officer. Indeed, any chest pain which is not readily identifiable as chest wall pain or pain from the abdomen should be referred to a medical officer as soon as possible. This is especially true if the pulse is irregular, rapid, or weak.

14–10. Diseases of Arteries and Veins

a. High Blood Pressure. High blood pressure is defined as blood pressure greater than 140/90. There are many causes of high blood pressure, including diseases of the kidneys and blood vessels and tumors of the adrenal glands, but in most cases the cause is

unknown. Psychologic factors may be present since more hypertension is seen in "worriers" and "hard drivers" than in other types of persons. The disease is dangerous because the high pressure damages various organs, especially the heart, brain, and kidneys. Treatment includes removal of the underlying cause if possible, drugs to lower the blood pressure, rest, sedation, and low salt diet. The individual should be evaluated by a medical officer.

b. Arteriosclerosis. This is a disease in which there is hardening of the arteries. The wall of the artery thickens due to the formation of fat deposits and fibrous tissue, thus narrowing the artery and interfering with the flow of blood. Blood clots may form, blocking the artery completely. No treatment for the disease is known. It usually affects older persons and may be a natural result of aging. It is especially dangerous when the coronary arteries which supply the heart muscle are affected, because a heart attack may result.

c. Thrombophlebitis. This is a disease in which a vein becomes inflamed and a clot forms in it. Symptoms include fever, tenderness along the course of the vein, swelling if the vein is in an extremity, and the presence of a hard, tender cord if a superficial vein is involved. Treatment is local heat, rest, and elevation if the extremities are involved. The patient should be referred to a medical officer. A serious complication of thrombophlebitis is pulmonary embolism, in which a clot breaks loose from the involved vein, travels through the right heart, and lodges in the pulmonary artery. This may cause death.

CHAPTER 15

DISEASES OF THE DIGESTIVE SYSTEM

15–1. Anatomy of the Digestive System

a. The mouth, or oral cavity, is the beginning of the digestive tract (fig 15–1). Here, food is ground into small particles and mixed with saliva for swallowing. Saliva moistens food and makes it easier to chew and to swallow. Enzymes in saliva break starches into sugars, which is the beginning of chemical digestion. About 1,500 cc. of saliva is secreted daily.

b. The main function of teeth is to grind food to make it easier for enzymes to act upon and to lessen difficulty in swallowing. Chewing, swallowing, absorption, peristalsis, and defecation make up the mechanical part of digestion. Diseased or missing teeth may result in improperly chewed food, causing improper digestion deeper in the digestive tract. Swallowing large chunks of improperly chewed food adds to the work of the rest of the digestive tract.

c. The tongue is a muscular organ attached to the back of the floor of the mouth. The tongue works with the teeth by shifting and positioning food so that chewing can occur more efficiently. The tongue then propels the bolus (rounded mass of chewed food) from the mouth into the pharynx. This is the first stage of swallowing. Another function of the tongue is its use in speech and taste.

d. The pharynx is a muscular canal leading from the nose and mouth to the esophagus and larynx. Passage of food from the pharynx into the esophagus is the second stage of awallowing. During swallowing, the epiglottis closes the larynx so that food does not enter there but travels into the esophagus.

e. The esophagus is a muscular tube about 10 inches long, leading from the pharynx to the stomach. It is lined with mucous membrane and positioned directly behind the trachea. Its function is to complete the act of swallowing. Food is moved down the esophagus by waves of muscular contraction called "peristalsis." When vomiting occurs, the peristaltic wave is reversed.

f. The stomach is an expanded portion of the alimentary canal. It is an elongated, pouch-like structure lying just below the

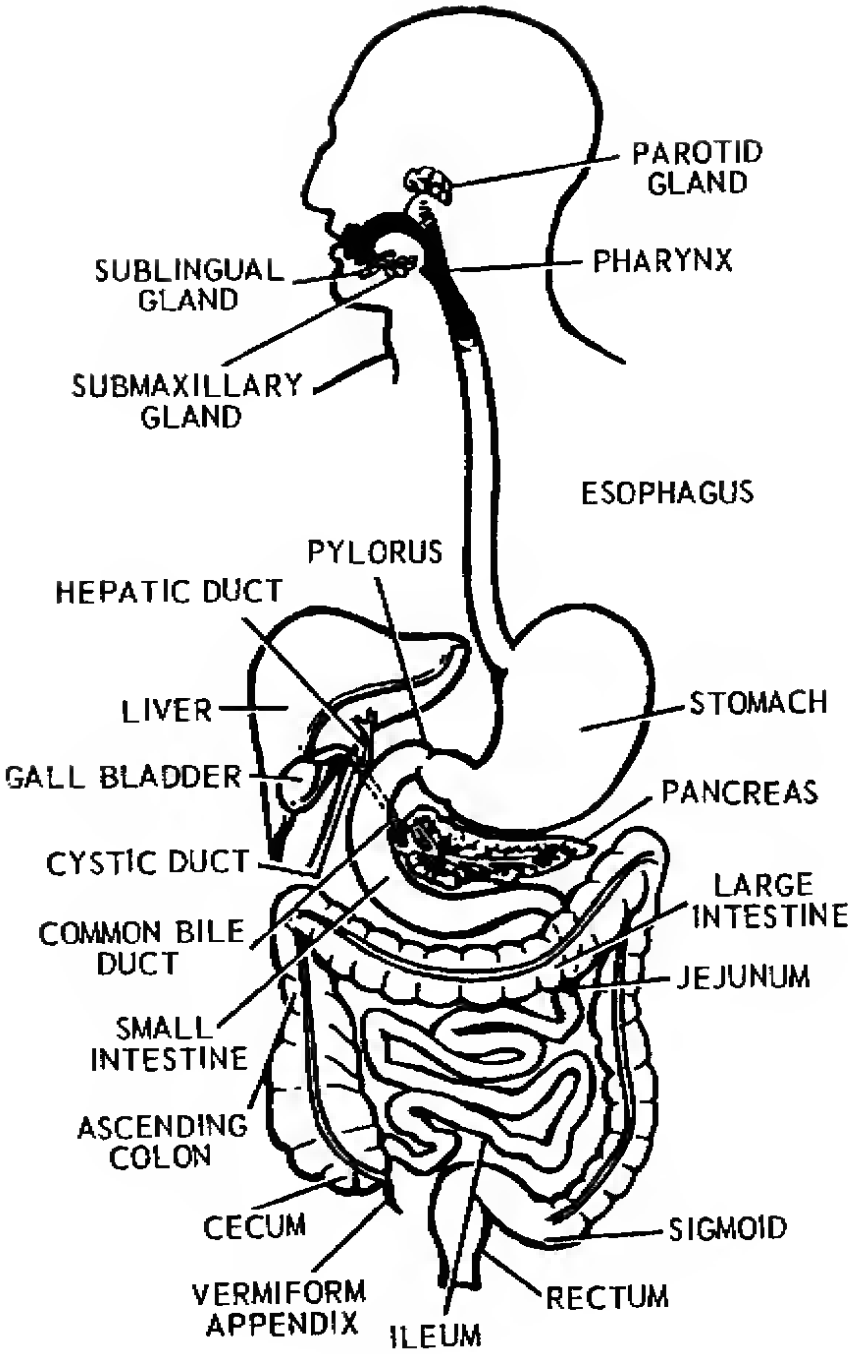


Figure 15–1. The digestive system.

diaphragm, mostly to the left of the midline. Circular sphincter muscles act as valves and guard the openings into and out of the stomach. The stomach has two main functions.

(1) The stomach is a reservoir for food. It expands when receiving food and contracts as it releases its contents through the pyloric valve into the duodenum. In addition, the stomach churns the food and breaks it down further for mixing with the gastric juices.

(2) Glands in the lining of the stomach produce gastric juices and hydrochloric acid. Gastric juices contain two enzymes which break proteins into simpler forms. Mucous membrane lining the stomach protects the stomach itself from being digested by the acid and enzymes. Food leaves the stomach as a semi-liquid.

g. The small intestine is a tube about 22 feet long. It extends from the pyloric valve to the cecum. The pyloric valve is a valve at the lower end of the stomach connecting to the upper end of the small intestine. This valve opens to allow the stomach contents to enter the small intestine. The cecum is the first portion of the large intestine. The small intestine is divided into three parts: duodenum, jejunum, and ileum. The duodenum is lined with small glands which secrete juices for digestion. The food is completely digested and absorbed into the bloodstream in the remainder of the small intestine. Only wastes and water remain to enter the cecum.

h. The large intestine is a tube about 5 feet long. It extends from its junction with the small intestine to the rectum. At the junction of the small and large intestines is the cecum, which is a blind sac located on the lower right side of the abdomen. Attached to the lower end of the cecum is the appendix, a tail-like structure about 3 inches long with no known function. The ascending colon portion of the large intestine extends along the right side of the abdomen from the cecum up to the region of the liver. There the large intestine bends and continues horizontally across the upper portion of the abdomen to the spleen. This portion is known as the transverse colon. The large intestine bends again and continues down the left side of the abdomen (descending colon). The lower portion of the large intestine (sigmoid colon) makes an S curve toward the center and rear of the abdomen and ends in the rectum. The primary function of the large intestine is the absorption of water from undigested food and waste it receives from the small intestine. As this mass passes through the large intestine, water is absorbed from it and into the circulatory system. What remains is waste or fecal matter. Fecal matter is stored in the rectum until defecation takes place.

i. The liver is a large organ located in the upper right portion of the abdomen. It is responsible for many chemical reactions

critical to life. In addition, the liver secretes a digestive juice called bile. Bile is stored in the gall bladder under the liver and enters the duodenum through the bile duct. The pancreas lies just to the left of the duodenum, under the stomach. Like the liver, the pancreas also secretes digestive juices which enter the duodenum through a duct (pancreatic duct). The pancreas also produces insulin which passes into the blood and controls the sugar in the body.

15–2. Useful Descriptive Terms

a. Anorexia. Loss of appetite.

b. Diarrhea. Frequent and watery fecal discharges; the opposite of constipation.

c. Enzyme. A protein or other organic compound which speeds changes in the digestion of foods.

d. Feces. The excrement discharged from the intestines.

e. Gastric. Pertaining to the stomach.

f. Hematemesis. Vomiting of blood.

g. Ingestion. The act of taking in food for digestion.

h. Jaundice. Yellow; yellowness of the skin and eyes.

i. Melena. Black tarry bowel movement.

j. Metabolism. The sum of the physical and chemical changes in the living cells by which the function of nutrition is effected after absorption; energy is provided for the vital activities and new material for repair.

k. Nausea. A sick feeling in the stomach.

15–3. Gastric Conditions (Abdominal Pain, Nausea, Vomiting)

a. Heartburn. This is a condition in which an excess of hydrochloric acid is produced in an effort to digest an abnormal amount or kind of food. Acid fumes are expelled with gas from the stomach through the esophagus, producing a burning sensation. Since the esophagus is close to the heart, the patient complains of heartburn. Actually, it has nothing to do with the heart. It is treated with an antacid such as Gelusil.

b. Indigestion. This term is used when the stomach has difficulty breaking down and liquefying food. Indigestion may be caused by food that is not chewed enough and swallowed in large chunks, by bulky dry food eaten without enough liquid, or by dry food eaten while the body is dehydrated. Better eating habits and intake of more liquids may be the only treatment needed for indigestion. Antacids may be helpful. Indigestion associated with acticity may be a symptom of cardiac disease.

c. Gastritis. Highly seasoned food, some infections, excessive alcohol, and certain chemicals and medicines may irritate the lining of the stomach, resulting in nausea, loss of appetite, burning, pain, belching, vomiting, and hematemesis. Antacids may be helpful, but mainly the patient needs to be advised about his dietary habits. If the symptoms persist, especially with fever, infection is likely and the patient should be seen by a medical officer.

d. Peptic Ulcer. This is an open lesion (sore) in the lining of the stomach or duodenum. The lesions may be simple ulcers without severe inflammation or pain. They may produce intense pain, bleed, obstruct the stomach or duodenum, or they may perforate into the abdominal cavity. Peptic ulcers are related to stomach acid and to stressful situations such as worry, frustrations, and inability to adapt to changing situations. In the management of the peptic ulcer patient, consultations with the chaplain and psychiatrist are often a part of the treatment. Usual symptoms of peptic ulcer are pain and burning, which are more intense before eating, nausea, vomiting, hematemesis, loss of appetite, and frequent indigestion. Frequent small meals, administration of an antacid, and management of mental state are the main considerations in treating peptic ulcer. If you suspect peptic ulcer, refer the patient to a medical officer.

e. Food Poisoning. This is a term applied to a condition resulting from ingestion of foods containing certain microorganisms or toxins produced by them, poisonous shellfish, or foods contaminated with poisonous chemicals. Symptoms include vomiting, pain, and headache. In the field, treat food poisoning with large amounts of water and induce vomiting. Evacuate the patient as rapidly as possible.

f. Gastrointestinal Allergy. This is a disease manifested by nausea, vomiting, abdominal pain, and diarrhea after the patient has eaten certain foods. For example, some persons are allergic to eggs, strawberries, or seafood. Occasionally, the allergic reaction may involve other portions of the body and hives and wheezing may result. The disease is prevented by avoiding the offending food. Evacuation may be required for severe reactions.

15–4. Diarrhea

Diarrhea is the primary manifestation of disease of the intestine. When the intestines are diseased, they do not absorb food and water properly. As a result, food and water are excreted from the rectum. These watery bowel movements may number 20 or more a day, depending upon the cause and severity of the problem. The most common cause is infection, usually viral. The treatment for simple abdominal cramps and diarrhea is rest, fluids (usually oral), and medication, such as Kaopectate, to add bulk to the stool. Fluids are most important. Do not let your patient become dehydrated; that can be fatal. If either the cramping or diarrhea

worsens or does not improve in 2 to 3 days, refer the patient to a medical officer. If a fever accompanies the diarrhea, or if there is pus or blood in the stool, evacuate the patient. These circumstances may indicate a bacterial or parasitic infection of the intestines, which is much more serious than viral enteritis. Typhoid fever, cholera, and amebiasis are among diseases in this category. It is important to remember that most cases of diarrhea result from eating or drinking unclean foods or liquids or using unclean utensils. If you emphasize to soldiers the importance of using water purification tablets, eating only approved foods, and using clean eating utensils, you can do much to reduce the problem of diarrhea.

15–5. Abdominal Pain

Disease of almost any organ in the abdomen can produce abdominal pain. Pain in the upper part of the abdomen is common with simple indigestion or gastritis. Cramping pain in the lower part of the abdomen is common with viral enteritis and diarrhea. Yet, abdominal pain may be an important indication of a serious condition such as appendicitis. For this reason, never treat abdominal pain with analgesics such as aspirin or morphine unless the cause of the pain is obvious, as with a bullet wound, for example. Where the cause of the pain is not clear, observe the patient for several hours. If the pain lessens and disappears and the patient feels well, no further treatment is needed. If the pain remains the same or worsens, refer the patient to a medical officer. A helpful physical finding is *rebound tenderness*. This is tenderness evoked when the wall of the abdomen is *slowly* and *gently* compressed inward and then released suddenly. Sharp pain on the rebound indicates irritation of the lining of the abdominal cavity (peritoneum) and requires referral to a medical officer. Do not let the patient eat or drink anything. Rebound tenderness is present in fully developed appendicitis and in any severe abdominal infection. If a laboratory is available, a blood count can be done to help diagnose appendicitis. Usually the white blood cell count is elevated. However, a medical officer must make the evaluation in suspected appendicitis. If an infected appendix ruptures, the peritoneum becomes infected and death may result. Peritonitis, as this is called, is manifested by intense diffuse abdominal pain and board-like rigidity of the abdominal wall. The patient will tend to keep his knees drawn up to lessen the tension on the abdominal wall.

15–6. Intestinal Parasitic Infestation (Worms)

Worms from various origins may infect the intestinal tract. They are the roundworm, giant roundworm, hookworm, whipworm, pinworm, tapeworm, dwarf tapeworm, and beef, pork, and fish worm.

All may be ingested by eating contaminated foods or drinking contaminated water. Hookworms get into the body through the skin, usually the skin of the feet or lower legs.

a. Signs and symptoms are related to the type of worm infestation. Most symptoms include abdominal distress. Blood in the stool, anemia, and bowel obstruction are found in some cases. The most common presenting complaint is that the patient has seen worms in his stool.

b. Treatment depends on the identification of the specific worm involved. For that reason, the patient must be evacuated to an area where the stool can be examined by trained laboratory personnel. Drugs are available for treating specific types of worm infections.

c. Worms are spread through the intestinal discharges of the infected person. Food, water, and the hands are the most common vehicles for transmission of worms. Usually an entire family is infected. If one member of a family is infected with pinworm, the whole family should be treated. Reinfection or autoinfection is common, especially with pinworm.

15–7. Viral Hepatitis

a. Viral hepatitis is inflammation of the liver resulting from a specific viral infection. The virus may be transmitted by contaminated food, water, hands, needles, syringes, blood, or plasma. Signs and symptoms include jaundice, malaise, fever, nausea, vomiting, diarrhea, and clay-colored stool. A person may have the disease and show no signs or symptoms. He may recover from it and still have the virus in his blood. Hepatitis damages the liver cells so that the patient's liver cannot function adequately. Bile components, normally excreted into the intestine by the liver, instead "back up" into the bloodstream in hepatitis, coloring the skin and eyes yellow (jaundice).

b. There is no specific treatment for hepatitis. When it is diagnosed, the patient should be evacuated for rest, plenty of fluids, and a diet high in proteins and carbohydrates and low in fats. Preventive measures include using sterile or disposable syringes and needles. In addition, drinking water must be potable and food prepared under sanitary conditions. Good personal hygiene and sanitary discipline must be maintained. No vaccine for viral hepatitis is known.

15–8. Hemorrhoids (Piles)

Hemorrhoids are dilated veins in the wall of the rectum, or anal canal. If the veins are located at the junction of the skin and mucous membrane at the anus, the swelling protrudes from the anus and the hemorrhoids are external. If the veins are located in

the wall of the rectum, the swelling is not visible externally. In any case, they are often accompanied by pain on defecation, bright red rectal bleeding, and itching in the anal area. Relief may be obtained by the use of suppositories to lubricate the rectal walls and to soften fecal material. A local anesthetic, such as Dibucaine, may be mixed with a lubricant and applied to the affected area to relieve pain and to help elimination. Dehydration aggravates the condition. Hard, impacted fecal matter tears the hemorrhoids and makes them bleed. Constipation and straining at defecation may cause or aggravate hemorrhoids; therefore, a stool softener may be needed. In severe or chronic cases, the only recourse is surgical removal of the hemorrhoids.

CHAPTER 16
DISEASES OF THE GENITOURINARY SYSTEM

16–1. Genitourinary System

The genitourinary system consists of the urinary organs for the production and discharge of urine and the genital organs, which are used in reproduction.

16–2. Urinary System

The urinary system is composed of organs for filtering and excreting wastes from blood. The urinary organs are two kidneys, two ureters, one urinary bladder, and one urethra. This system helps to control the water balance of the body. During formation of urine, wastes are removed from circulating blood for elimination.

a. Kidneys. The kidneys are bean-shaped organs about 4 inches long, 2 inches wide, and 1 inch thick. They lie on each side of the spinal column, against the muscles of the back, beneath the diaphragm and behind the peritoneum. The renal artery and renal vein enter each kidney at its central notch, the hilus. The kidneys filter the blood, remove liquid wastes (urine content), and retain in the circulation the usable portion to maintain the body's fluid balance.

(1) Acute pyelonephritis is an acute inflammation of the kidneys caused by bacterial infection. Bacteria may reach the kidneys through the bloodstream or a ureter. Infection is likely to occur if the free outflow of urine is blocked and urine stagnates.

(2) Symptoms of acute pyelonephritis include the sudden onset of chills, fever, pain, and tenderness in the upper back just below the ribs. Laboratory study of the urine may show pus cells (white blood cells). Pain during urination is a common symptom of kidney infection. Treatment includes a high fluid intake and specific antibiotics.

b. Ureter. The pelvis of each kidney is drained by the ureter, a muscular tube extending from the hilus to the urinary bladder. Some stones formed in the kidneys pass through the ureters to the bladder. Often, the passage of stones causes pain and lacerates ureter walls causing blood in the urine. A stone in the ureter may block the flow of urine and lead to an infection of the urinary tract

above the blockage because of stagnation. These symptoms may be confused with symptoms of other urinary inflammations. The ureters may also be infected by organisms invading either the kidneys or the bladder.

c. Urinary Bladder. The urinary bladder is a muscular sac which stores urine. It is located in the lowest part of the abdomen just behind the pubis, which is under the pubic hair. The bladder's size varies with the amount of urine it contains. The average bladder holds about 500 cc. When 200 to 300 cc. of urine collects in the bladder, sensory nerves carry a sensation of fullness to the brain, causing a desire to urinate. Urination involves relaxation of the bladder's sphincters and contraction of its walls which force urine out through the urethra.

(1) Cystitis, or inflammation of the bladder, may result from microorganisms traveling up the urethra into the bladder, traveling down the ureters into the bladder, or being introduced into the bladder during catherization.

(2) The symptoms of cystitis are a burning pain in the region of the urinary bladder, burning pain with urination, frequency, urgency, and sometimes pus or blood in the urine. Cystitis will usually respond to antibiotics and a high fluid intake. The causative organism should be determined in the laboratory if possible so that the proper antibiotic can be chosen.

d. Urethra. The urethra is the tube that carries urine from the bladder to the outside. It is about 6 to 8 inches long in the male and about 1½ inches long in the female. The male urethra is divided into three parts: the prostatic, which passes through the prostate gland; the membranous, between the prostate and penis; and the anterior, the part in the penis. The only important urethral disease is urethritis (para 16–3).

16–3. Nonspecific Urethritis

Nonspecific or nongonococcal urethritis is not classed as a specific disease until the causative organism is identified. It may be traced to any of a number of causative organisms. Frequently, its cause is impossible to determine. Nongonococcal urethritis may be associated with syphilis, lymphogranuloma venereum, chancroid, protozoan infection, and certain fungus infections. Although not generally classed as a venereal disease, nonspecific urethritis may be venereal in origin.

a. Symptoms of nonspecific urethritis include a discharge or pain in the urethra, glans, testicles, perineum, and inguinal regions. The common types of urethral discharges are purulent, mucopurulent, and serous.

b. Smears from about one-fifth of the patients with urethritis show pus and epithelial cells, but often no organisms can be demonstrated on culture. Nonspecific urethritis is differentiated from gonococcal urethritis by the absence of the gonococcal bacteria on smears of the discharge examined under the microscope and on culture of the discharge.

c. Treatment is directed toward the causative organism if it can be determined. The wrong antibiotic, especially in inadequate dosage, may mask the causative organism and make a positive diagnosis very difficult. If a specific organism cannot be found, a broad spectrum antibiotic such as tetracycline is often used. Antibiotics should be prescribed only by a medical officer after careful laboratory studies.

16–4. Useful Descriptive Terms

a. Dys. Prefix denoting painful or difficult urination, as in dysuria.

b. Gonad. Testicle or ovary.

c. Hematuria. Discharge of urine containing blood.

d. Incontinence. Inability to control voiding of urine.

e. Purulent. Containing, consisting of, or forming pus.

f. Pyuria. Pus in the urine.

g. Renal. Referring to the kidney.

h. Scrotum. Pouch containing the testicles.

16–5. Venereal Diseases

Venereal diseases are those diseases transmitted primarily by sexual intercourse or other close physical contact. Because of the lack of information and education and because of misinformation and fear about these diseases, many infected persons fail to seek adequate medical treatment. Education and information aimed at prevention, early detection, and adequate treatment are mandatory to control venereal diseases.

16–6. Gonorrhea

Gonorrhea is an infectious disease involving chiefly the mucous membranes of the genitourinary tract, rectum, and cervix. It occasionally spreads through the blood to serous and synovial membranes to other parts of the body.

a. The cause of gonorrhea is the gonococcus (GC) organism. It damages the epithelial tissue lining the urethra and produces pus. If a smear of the pus is made on a slide, stained properly, and placed under the microscope, the gonococcus is usually seen.

b. Typically, gonococcal disease in the male is dysuria, with or without pyuria. Frequently, dysuria with itching occurs 1 or 2 days before the pyuria. Patients refer to the pyuria as a "drip." The incubation period (interval between infection and onset of first symptoms) is 2 to 14 days. Some male gonococcal disease is

asymptomatic. Untreated gonococcal disease may spread through the bloodstream. Late effects of untreated gonorrhea in the male include stricture and sterility.

c. In the female, primary infection of the urethra, cervix, and rectum is usual. Gonorrhea in the female can be very difficult to diagnose due to early mild symptoms and inaccessible infected sites. The infection may go unnoticed in many cases. As the infection progresses, there is a purulent discharge which may also be unnoticed. Late effects may be pain and discomfort. If not treated, the infection may involve the uterus and fallopian tubes. If the gonococcus destroys the lining of the fallopian tubes, adhesions of the walls of the tubes may occur which could obstruct them permanently. This obstruction can result in sterility.

d. The drug of choice for treating gonorrhea in men or women is penicillin. The recommended dose for males in continental United States is 2.4 million units of aqueous procaine penicillin given intramuscularly. It is recommended that women receive 4.8 million units as initial treatment. All these patients should have a followup examination to insure adequacy of treatment. For infections resistant to penicillin and for individuals allergic to penicillin, tetracycline may be used. In all cases, treatment should be determined and supervised by a medical officer. Benzathine penicillin (long-acting Bicillin) causes the gonococci to develop resistance, and it must not be used in treating gonococcal diseases.

16–7. Syphilis

Syphilis is an acute and chronic venereal disease which may involve any organ or tissue. It may exist without symptoms for years.

a. Syphilis is caused by bacteria called spirochetes. It is usually transmitted directly from an infected person, or by transfusions of infected blood or plasma, or by passage from mother to fetus. The spirochete is fragile and will not live outside the human body, although it may survive in blood for transfusion. It is easily killed by sunlight, drying, antiseptics, and antibiotics, especially penicillin.

b. The spirochete usually passes from one person to another during sexual intercourse. Within 3 to 10 days a lesion may appear at the site of infection. This lesion, called "primary chancre," heals in about 7 to 10 days even if untreated. It is during the primary chancre phase that the individual is most likely to infect others. The lesion will usually be indented, or saucer shaped, and filled with a pus-like exudate. If the lesion is touched or probed, it produces little pain to the infected person. The lesion is said to be "painless." In fact, it may be small and never noticed by the patient. At this point, the patient should be directed to the laboratory, where a sample of the lesion will be placed under the microscope. The diagnosis then can be made by microscopic observation of the spirochete.

c. The lesion will disappear in a short time, with or without treatment, but the disease remains active in the body. The organisms enter the lymphatics and blood and go on to lodge in other tissue. Those which lodge in the skin and mucous membrane produce visible lesions and rashes, a condition called secondary syphilis. The organisms found in lesions of the skin and mucous membrane may infect other people. The organisms which lodge in the other organs such as the heart, brain, or liver destroy tissue. When these organs become involved, as long as 10 or 20 years later, the disease is called tertiary syphilis.

d. During the secondary or later stages of syphilis, the disease can usually be detected by a serologic blood test. The blood test becomes positive 14 to 90 days after infection. This is called a "serology," because blood serum is used in most laboratory tests for syphilis.

e. Penicillin is the drug of choice for the treatment of syphilis. The usual treatment is two doses of 2.4 million units given a week apart. If the infected patient is allergic to penicillin, tetracycline is the next drug of choice. Treatment must be directed by a medical officer. A serology should be done 2 months after treatment and repeated each 6 months until at least two negative results are obtained. It is the responsibility of the treating physician or medic to get the patient to return for these repeat serologies. There is no immunization against syphilis.

16–8. Granuloma Inguinale

Granuloma inguinale is characterized by granular, purulent lesions of the skin in the region of the groin, often involving the genitalia. If granuloma inguinale is left untreated, the organisms will spread over a large area and produce a large, foul-smelling ulceration. This ulcer tends to bleed freely. The incubation period is 1 week to 12 weeks, but once established, the lesion may spread quickly. Positive diagnosis is made in the laboratory. The drug of choice for the treatment of granuloma inguinale is tetracycline. As a rule, the older and more extensive the lesion, the longer the duration of therapy.

16–9. Chancroid

Chancroid is a highly infectious venereal ulcer which infects the genitalia of both men and women. It is spread by sexual contact. The ulcer is caused by a bacterium called Hemophilus ducreyi. Positive identification of the causative organism must be made in the laboratory. The sore, or ulcer, usually appears in 3 to 5 days

after exposure and grows rapidly. It has abrupt edges and a rough floor, and usually is painful and inflamed. Initially, it resembles a syphilitic ulcer. A syphilitic ulcer is painless, while the chancroid ulcer is very painful. The syphilitic lesion is usually singular and limiting in size. The chancroid ulcer may be multiple and enlarging. After the lesion heals, scar tissue remains. Major portions of the penis or vulva may be destroyed by chancroid if it is not treated promptly and adequately. Chancroid-like lesions must be evaluated by a medical officer so that a specific diagnosis can be made. Chancroid is treated with a sulfonamide.

16–10. Lymphogranuloma Venereum

Lymphogranuloma venereum usually starts with a small papule, which may be so small it is not noticed by the patient. This venereal disease is caused by a virus. Its symptoms which bring a patient to the dispensary are usually fever, headache, myalgia, and malaise. Swollen tender inguinal lymph nodes develop as the disease progresses. You should always suspect plague first when you see swollen inguinal nodes. Lymphogranuloma venereum responds to antibiotics and frequently requires hospitalization for much of the treatment.

16–11. Differential Diagnosis

Frequency	Pyelonephritis, cystitis, urethritis, prostatitis.
Urgency	Pyelonephritis, cystitis, urethritis, prostatitis.
Burning on urination	Pyelonephritis, cystitis, urethritis, prostatitis.
Retropubic pain	Cystitis.
Fever	Pyelonephritis, cystitis, prostatitis.
Pus-like discharge from urethra	Prostatitis, urethritis
Sore on penis	Syphilis, lymphogranuloma venereum, chancroid, granuloma inguinale.
Chills	Pyelonephritis.
Pain in upper back	Pyelonephritis.
Pain in lower back	Prostatitis.
Swollen inguinal lymph nodes	Chancroid, lymphogranuloma venereum.

CHAPTER 17

DISEASES OF THE NERVOUS SYSTEM

17–1. Nervous System

The nervous system may be divided into three main areas according to functions. They are the central, peripheral, and involuntary (autonomic) nervous systems.

17–2. Central Nervous System

a. Brain. The central nervous system is composed of the brain and spinal cord. It receives information from the peripheral and autonomic nervous systems. It evaluates the information, stores some of it, and sends appropriate responses. The main parts of the brain are the cerebrum, cerebellum, and medulla. The cerebrum receives, stores, interprets information, sends messages, and records general and special sensations. As the highest level of the nervous system, this is where thinking and memory take place. The cerebellum lies below the cerebrum. It coordinates muscular activity, regulates muscle tone, and serves as the center for reflex action and equilibrium. The medulla is found at the base of the brain near the spinal cord. It contains the centers for the control of blood pressure, heart rate, and rate and depth of respiratory movements.

b. Spinal Cord. The spinal cord is a cord of nervous tissue about 18 to 20 inches long located in the spinal canal inside the vertebral column of the back. The cord serves as a connecting cable of nerves between the brain and the rest of the body. It also contains some centers for basic reflex actions.

17–3. Peripheral Nervous System

The peripheral nervous system receives and transmits information between the outlying part of the body and the central nervous system. The system has two parts, sensory and motor. The sensory nerves carry impulses from the surface of the body to the brain. Impulses from the brain to the muscles travel along the motor nerves. The sensory and motor nerve fibers of the body make up the peripheral nervous system.

17–4. Autonomic Nervous System

Autonomic means self-controlling. For example, if the extremity muscles need more blood for an emergency, one part of the autonomic nervous system speeds the heart to pump more blood. Blood vessels in the muscles dilate so that more blood can get to them. Another part, meanwhile, will slow the organs of digestion and constrict their blood vessels, making this blood available for the muscles. When the emergency need no longer exists, the reverse action takes place. The autonomic nervous system also controls heart rate, breathing rate, intestinal motility, eye dilation, and many other functions.

17–5. Useful Descriptive Terms

a. Anesthesia. Loss of sensation; local anesthesia is a loss of sensation limited to a part of the body.

b. Anxiety. A feeling of apprehension, uncertainty, and fear, often accompanied by restlessness.

c. Ataxia. Loss of coordination.

d. Bilateral. Pertaining to or affecting both sides of the body.

e. Conversion Reaction. The unconscious conversion of an emotion into physical manifestations and *belief* by the patient that he is ill.

f. Emotional Instability. Inability to cope with a situation; given to easy rage, brooding, and widely fluctuating moods.

g. Encephalitis. Inflammation of the brain.

h. Hemiplegia. Paralysis of one-half of the body (arm and leg on one side).

i. Hypnotic. Drug which produces sleep.

j. Neuralgia. Pain which extends along the course of one or more nerves.

k. Neuritis. Inflammation of nerves.

l. Neuropsychiatric. Pertaining to mental or nervous disorders.

m. Neurotoxic. Poisonous to nerve tissue.

n. Paralysis. Loss of the power of motion.

o. Paraplegia. Paralysis of both legs.

p. Poliomyelitis. Acute viral infection involving the spinal cord.

q. Psychogenic. Originating in the mind.

17–6. Headache

One of the most common complaints of patients is headache. Most headaches are nonspecific and indicate no serious condition. However, frequent or very severe headaches may be a danger signal. Always check the blood pressure when headache is a complaint.

a. Tension Headache. Tension headache is the commonest type of headache. Tensing the neck and scalp muscles for long periods of time will tire the muscles and cause a headache. Tension headache is often seen in men stationed on lookout or at a listening post. Continuous stress, like that placed on the "point-man" or scout, leads to tension headache. Drivers of tanks and trucks also complain of tension headache due to keeping their eyes fixed on the road for long periods of time. Continuous noise, or long periods of extreme quiet, will cause tension headache. Emotional stress also produces it. Tension headaches are relieved by rest, and the history essentially establishes the diagnosis. Aspirin is very helpful.

b. Other Headaches. If there is no history of physical or emotional stress and the headache is not relieved by rest or sleep, there is potential cause for concern. The patient should be seen by a medical officer, as he may have a serious or even life-threatening condition.

17–7. Unconsciousness

Unconsciousness means the patient is completely unaware of what is going on around him and is unable to make purposeful movements. Sleep is the only normal unconsciousness. Fainting is a brief unconsciousness. Coma is prolonged unconsciousness. Stupor is partial, transient unconsciousness. The commonest causes of abnormal unconsciousness are cerebral vascular accident (stroke), head injury, heat stroke, poisoning, alcoholism, hypoxia, and epilepsy. Acute alcoholic intoxication can suppress respiration and cause death. Often the cause of unconsciousness is not apparent. Until specific treatment can be started, do these things.

a. Examine the patient carefully. Be certain that his airway is not obstructed. Look for head injury, signs of bleeding, heat stroke, and poisoning.

b. Do not move him needlessly. Generally, it is best to let him lie in place.

c. Do not give him anything by mouth.

d. Do not give him morphine.

e. Refer the case to a medical officer.

17–8. Diseases of the Central Nervous System

a. Meningitis. This is an inflammation of the meninges, which are protective membranes surrounding the brain. The inflammation may be caused by a virus or one of many bacteria. Signs and symptoms include headache, stiffness of the neck, fever, and sometimes coma. In some cases, the signs and symptoms may progress extremely rapidly. Meningitis may be a life-threatening disease which can kill within hours of onset. Therefore, you must be alert to this possibility in any patient with fever and a stiff neck. Treatment depends on the type of organism found in the spinal fluid. The patient must be evacuated to a medical treatment facility with

adequate laboratory facilities as soon as possible. For bacterial meningitis, large doses of specific antibiotics will be given by the medical officer after performing a lumbar puncture and examining the spinal fluid under a microscope to determine the type of bacteria present.

b. Poliomyelitis. Poliomyelitis, or polio, is a viral infection of the central nervous system involving motor nerve cells in the spinal cord and brain stem. Some or all of these motor nerves may be damaged or destroyed, resulting in paralysis of the voluntary muscles. The disease is prevented by administration of the polio vaccine.

CHAPTER 18

COMMON DRUGS AND THEIR USAGE

18–1. Medications Carried By the Aidman

The medications you use in the field should be based upon your knowledge and skill, the amount of weight you can carry on a mission, and the evacuation lag time. Of these, knowledge and skill are most important. The mission usually dictates how much and what kinds of drugs you carry. As an example, the average aidman on an ordinary 3-day mission may carry the following items:

a. ASA (Aspirin). Aspirin is the best drug you will carry. It is useful for fever and as an anti-inflammatory drug. It can be given to patients with painful minor injuries, bruises, and fever. The adult dose is two tablets every 4 hours. Carry about 50 tablets and try to keep them fresh.

b. Antihistamines. These are used as nasal and sinus decongestants in cold and allergies. A number of antihistamines are available. The one used most is Benadryl. (One tablet every 6 hours is usually given.) Carry about 24 capsules. Since antihistamines produce drowsiness, they should be used with extreme caution in individuals who must remain alert.

c. Anesthetic Ointment. This deadens the itching of insect bites and other skin rashes. Tetracaine, dibucaine, nupercaine, and other "caine" ointments are equally effective. Tetracaine is used most. Two tubes are enough to carry.

d. Antimalaria Tablets. In malaria-infested areas, soldiers generally take these tablets daily or weekly, depending on the type. Carry enough to supply the men for the duration of the mission.

e. Cough Medication. A coughing soldier may give away a position, so carry some cough lozenges. They are convenient to carry and easy to administer.

f. Indigestion Medication. Antacid tablets are commonly packaged in waterproof plastic. One or two tablets may be chewed or dissolved in water to relieve indigestion.

g. Salt Tablets. When operating in hot weather, many aidmen carry salt tablets. When troops are sweating a lot, losing body water and salt, they are subject to heat exhaustion. One or two salt tablets dissolved in a canteen of water will help prevent heat

exhaustion. A pint of this solution every half hour may be needed under strenuous conditions in a very hot climate.

h. Tablets for Nausea and Vomiting. Nausea frequently accompanies many minor viral infections. It is also a sign of heat exhaustion. For nausea, an antiemetic such as Compazine or Tigan may be given. Because of undesirable side effects which may occur, discuss the use of these drugs with a medical officer before taking them with you.

i. Morphine. Morphine is the best drug for severe pain such as that produced by most battle injuries. It should never be given to any patient with a head injury, breathing difficulty, unconsciousness, or abdominal pain of uncertain cause. Because it is a narcotic, a medical officer will determine how much morphine you will carry and the dose to give.

j. Water Purification Tablets. It is the individual soldier's responsibility to carry water purification tablets. For those who fail to do so, you should carry an extra bottle of the tablets.

k. Anti-diarrheal Drugs. Kaopectate-type liquids are the most readily available (in powdered form). Carrying one bottle of this may be very helpful. The dose is three or four capfuls every 2 to 3 hours until the diarrhea subsides.

18–2. Misuse of Antibiotics

The use of certain drugs, notably antibiotics, in the field is contraindicated. Antibiotics are the drugs most often misused by aidmen. Many times, it may do more harm than good to give antibiotics in the field. Adverse conditions likely to develop from field use of antibiotics include the following:

a. Serious drug reactions may occur which you cannot handle, especially when penicillin is administered.

b. Inadequate dosage may make organisms resistant to an antibiotic and seriously hamper further treatment with it.

c. Giving the wrong antibiotic or an inadequate dose may mask the causative organism and make it difficult, or impossible, for the laboratory to identify it.

d. Giving the wrong antibiotic or an inadequate dose may also mask the signs and symptoms of the disease, making diagnosis difficult for the medical officer.

APPENDIX

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